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CONTRACTS CLOSED FOR TWO MORE VESSELS.

Contracts were closed on Tuesday with the American Ship Building Co. for two new freighters—one of 5,500 tons capacity and the other of 6,200 tons capacity—by the National Transportation Co., of which Capt. W. W. Brown of Cleveland is to be the general manager. In addition, the company purchased the three boats which the ship building company is now building for the Mutual Steamship Co. These three vessels are of 4,800 tons capacity but it was decided to lengthen one of them 24 ft., which will give her a capacity of 5,200 tons. It was the original intention of the National Transportation Co. to place an order for five new vessels, but with all the berths in the different plants of the ship building company filled General Manager Wallace was unable to take an order for five vessels for delivery in April, 1902. Negotiations were therefore begun for the freighters building for the Mutual Steamship Co. This company was organized by the late William Fitzgerald, and since his death the stockholders had decided to dispose of the boats should a favorable opportunity offer. This transaction will enable the National Transportation Co. to come out at the opening of the season with a fleet comprising two vessels of 4,800 tons capacity, one of 5,200 tons, one of 5,500 tons and one of 6,200 tons, or a combined capacity of 26,500 tons per trip. This makes a total of nineteen freighters and three passenger steamers which the American Ship Building Co. has under contract and constitutes more tonnage than was ever ordered in one season before. The combined carrying capacity in a single trip of the nineteen freighters on 18 ft. draught is 104,000 gross tons.

The National Transportation Co. is the same company the prospectus of which was lately issued in Chicago. At that time it was the intention to incorporate it on a basis of $5,000,000 and to build ten steamers. Mr. Charles Counselman of Chicago and Mr. W. H. Prime, well known in marine insurance circles, were to be heavily interested with Mr. Lyman C. Smith of Syracuse, N. Y. Mr. Counselman and Mr. Prime, having other extensive interests to look after, decided later not to join in the enterprise. Capt. W. W. Brown, who has been identified with Mr. Smith in a number of undertakings, then went ahead and organized the company upon a basis of $2,500,000 and cut the number of vessels to five. The company was organized at Syracuse, N. Y., this week and will be incorporated under the laws of New Jersey. Lyman C. Smith of Syracuse will be president, Capt. W. W. Brown of Cleveland secretary and manager, and H. W. Smith of Syracuse treasurer. The following are the directors: L. C. Smith, William Nottingham, Charles M. Warner, George B. Leonard, H. A. Smith, Horace S. Wilkinson, all of Syracuse; W. W. Brown and J. B. Cowle of Cleveland, and A. G. Brower of Utica.

A TRIPLE LAUNCHING.

The three torpedo boat destroyers, Truxtun, Whipple and Worden, were launched together on Thursday of this week at the Maryland Steel Co.'s yards, Sparrow's Point, Md. The construction of these boats was begun early in 1900, but considerable delay was caused on account of the slow delivery of material. The boilers and a considerable part of the auxiliary machinery, pumps, blowers, etc., are in position and the main engines will now be put in place. These boats are the largest in length and displacement of their class and are being built after the contractor's own plans in contrast to many of the same lot which are from government plans. Although there have been several double launches, it is understood that this is the first time for any yard in America to launch in one day three vessels of any considerable size.

The three boats lay on parallel ways side by side. A special electric automatic device had been arranged at the head of each pair of groundways for the releasing of the cradles and at the touch of the electric button, one destroyer after another in quick succession glided gracefully into the water.

Mrs. Emelie B. N. Worden of New York, a relative by marriage to Admiral Worden, christened the destroyer bearing that name. The Truxtun was christened by Miss Isabelle Truxtun of Norfolk, granddaughter of Commodore Truxtun, and the Whipple by Miss Elsie Pope of St. Paul.

WILL PUT ANOTHER LIGHT-SHIP ON SOUTH EAST SHOAL.

A meeting, called by Capt. George P. McKay, chairman of the committee on aids to navigation of the Lake Carriers' Association, was held in the office of J. C. Gilchrist, Cleveland, on Wednesday, to take steps to replace the light-ship recently destroyed by fire on the south east shoal, Point au Pelee passage. There were present at the meeting Messrs. J. C. Gilchrist, H. Coulby, William Gerlach, Edward Morton, W. W. Smith, J. J. H. Brown, T. T. Morford, Edwin S. Mills and George P. McKay. It was the unanimous opinion of those present that the old light-ship Smith & Post should be replaced with another light-ship. Letters to this effect were also received from Messrs. R. R. Rhodes, C. W. Elphicke, G. W. Maytham, W. A. Livingstone, G. L. Douglass, B. W. Parker, D. Sullivan and James Corrigan. Messrs. George P. McKay, H. Coulby Edward Morton, William Gerlach and W. W. Smith were appointed as a committee to see that another light-ship was placed upon the shoal at the earliest possible moment. The committee met on Thursday morning and decided to invite tenders for furnishing a suitable vessel for this work. Such tenders should be addressed to Capt. George P. McKay, Perry-Payne building, Cleveland, and must state equipment, size and general description of the vessel. Both the selling price outright and charter price per day must also be given. The old schooner Smith & Post, which served as a light-ship until burned, was chartered by the day, but the committee this time inclines to purchase if favorable terms can be secured.

BALL-THRUST-BEARING ON STEAMER GLADSTONE.

Last spring the steamer Gladstone of the Bradley fleet was equipped with a ball-thrust-bearing device upon its propeller shaft by the American Ball Bearing Co. of Cleveland and the result of the experiment has been most successful. By the introduction of the ball bearing arrangement upon the driving part of the machinery the steamer has been enabled to make a mile more per hour and the master of the vessel figures that he saves 320 lbs. of coal per hour. Mr. M. A. Bradley, the owner of the vessel, is quite enthusiastic over the result as far as it has gone. The Gladstone, to date, is the only vessel of his fleet so equipped, though he intends to equip two more at once.

"I figure," said Mr. Bradley, "that the vessel saves 10 per cent. in time—or 18 hours on a round trip of 1,800 miles. Her average season is fourteen round trips, or twenty-eight cargoes. With this device she ought to make an additional trip during the season. The master of the boat is very well pleased with the working of the ball bearing device upon the shaft, and says that he makes a mile more speed with less consumption of coal. The device uses neither oil nor water. It is quite an achievement to get a mile more speed out of an old boat like the Gladstone and we are watching the result with great interest. The ability to make an extra trip during a season would add considerably to the earning power of a vessel."

Regarding the construction and performance of the ball thrust bearing on the steamer Gladstone the American Ball Bearing Co. in a letter to the Review says:

"We beg to say that the bearing was designed by our Mr. Baker and embodies several improvements in ball bearing construction. Particular attention has been given to the necessary self-aligning features, that all twisting and bending strains, always present in vessels of such large proportions, shall not effect any unequal pressure on bearing. The bearing is entirely enclosed in a brass sheath and requires greasing but once in a season. This greasing is necessary only to prevent rust. The bearing has now been in constant use for about ninety days and very careful examination shows no wear whatever. Mr. Bradley has kindly sent us letters from the master of the Gladstone, whereby we are informed that a full mile per hour has been added to the speed of the boat, with a decided saving in fuel. To this remarkable showing must be coupled the fact that the constant water cooling and lubricating of former thrust-bearing is dispensed with by this improvement."

The Review will at a later date contain a full description of this bearing with drawings.

PRODUCTION OF IRON AND STEEL RAILS IN 1900.

The American Iron and Steel Association has completed its collection of the statistics of the production of all kinds of rails in the United States in 1900. In March last the production of Bessemer steel rails by the producers of Bessemer steel ingots in 1900 was given as amounting to 2,361,921 gross tons. To this total must now be added 21,733 tons of Bessemer rails made in the same year from purchased blooms and rerolled and renewed Bessemer rails, making a grand total for the year of 2,383,654 tons of Bessemer steel rails. In the same year we also made the largest quantity of open hearth rails in recent years, 1,333 tons, and the smallest quantity of iron rails ever recorded, 695 tons, which, added to the Bessemer steel rails above given, make the total production of rails in 1900 amount to 2,385,682 tons, the largest production ever attained in one year.

The following table gives the total production of rails in the United States in 1900 according to the weight of the rails per yard. Included in the total production are 101,312 tons which have been definitely reported to the association as street rails.

Kinds.	Under 45 lbs.	45 lbs. and less than 85.	85 lbs. and over.	Total. Gross tons
Bessemer	155,950	1,625,646	602,058	2,383,654
Open hearth	886	447	......	1,333
Iron	695	....	......	695
Total	157,531	1,626,093	602,058	2,385,682

The total production of all kinds of rails in 1899 was 2,272,700 tons, of which 133,836 tons weighed less than 45 lbs. to the yard, 1,559,340 tons weighed 45 lbs. and less than 85 lbs., and 579,524 tons weighed 85 lbs. and over 85 lbs. The street rails made in 1899 and reported to the association amounted to 154,346 tons.

Improvements at the Brooklyn navy yard to cost about $2,000,000 will soon be commenced by the yards and docks department. Within the next few weeks the department will advertise through the authorities at Washington for bids on the construction of four structures to cost in the neighborhood of $1,000,000. These buildings, with the erection of a great coaling pier from the coal dock, a number of buildings on the ordnance dock and the completion of work already under way will call for an expenditure of about $2,000,000.

The plans for a small revenue cutter for patrolling St. Mary's river are now ready and the department will soon ask bids for her construction. Congress provided an appropriation of $75,000 for the construction of this vessel. According to the plans, the vessel will be 110 ft. long, 20.6 ft. beam and 12 ft. deep, with a displacement of about 215 tons. She will be constructed of steel and have a steel deckhouse.

THE DENNY MODEL TANK AT DUMBARTON.

Com. J. D. Jerrold-Kelley of the United States navy gave a very interesting account in the Sunday New York Herald of the new system of testing ship's models in the tank used in the Denny ship yard at Dumbarton, England. In part he said:

At the Glasgow meeting this summer of the British Institution of Naval Architects Mr. Archibald Denny, of the well known Leven Ship Building Co., was asked by Mr. Yarrow if the researches made by the Denny firm with the model tank employed for testing the resistance of ships had been of practical utility. The designer and ship builder at once declared its utility to be so great that his firm often regretted it did not own two tanks instead of one, as both could be kept fully and profitably occupied. The subject under discussion was the benefit derived in the United States by the government and by private ship builders from the Washington model tank, and the liberality shown by naval officials in undertaking difficult inquiries for the private construction industries of the country. Mr. Denny's answer was evidently convincing, because then and there the institution, by unanimous vote, requested its council to take into serious consideration the question of providing for ship builders a model tank, where resistances may be tested, and where the data of bodies moving in the water may be collected, analyzed and converted into beneficent formulas for befogged and bewildered designers. All this shows that ideas march, even if in seasons they march slowly, perhaps lamely, and not to the beat of drum nor to the fanfare of trumpets, up the difficult road of peaceful endeavor. But it is curious that Great Britain, the originator of the government system of testing tanks, should have failed to provide this means of investigation for the builders and owners of the greatest merchant marine in the world. Foreign governments have long owned testing basins, open to private designers, and at Washington a tank built with the latest improvements is at the service of the people, and is already noted, not so much for the original researches made, but for the clever adaptation of new and more effected methods to old and apparently settled practices.

The Denny tank is distinguished above all others by the fact that it is the only one created by private enterprise. The government tank at Haslar is never idle, but the experiments made are for the exclusive use of the admiralty, and it is only on rare occasions that important discoveries are published. This is comparatively an old institution, for more than a quarter of a century has passed since William Froude established under government patronage at Torquay, England, the model tank that has done so much to make fairly exact the hitherto very inexact science of naval architecture. "It is not too much to say," writes a cautious expert, "that without the knowledge that Mr. Froude's labors have given to the world the marvellous results attained by ocean steamers at this end of the century would still be problems for the future." This to the unwary may seem fulsome praise, but not a word is misplaced, nor any adjective made too strong.

When steam propulsion began to change the commercial theories of the world, ancient ideas in ship modelling, "rule of thumb" practices, moss grown trade secrets and occult mysteries of the craft were of slight use in solving the new problems. Under sail it was and is different, for here the speed that may be attained is mainly a question of stability, of the power to carry large spreads of canvas without unduly or dangerously inclining or heeling the hull. This element, of course, demanded new treatment when propelling power ceased to be an unsetting force. Other factors, some old, some new, also vexed the designer, such, for example, as the relative proportions of length, breadth and depth; the form of entrance and of run, and the proportions, form and number of revolutions of the propelling agency, be this screw or paddle. The essential, vital factor is always stability, for this governs the safety of all and controls in great degree the behavior of the ship under the varied conditions of her cruising career. Only less important, however, were the obscure and hidden factors that are now generalized under the name of resistances.

From the beginning the inquiry has been pursued with the express intention of submitting to thorough experiment these vague elements of restraint and of determining by scientific processes the various proportions and forms of ships through the behavior of models whose proportions bear a definite ratio to those of the actual vessels under investigation. In this labor it became necessary to compare the relative resistances of the same model at various speeds, and those of different forms and proportions at equal speeds. Practical results were therefore needed to establish the truth or untruth of the relations that, according to mathematics, must exist between the full sized ship in smooth water and its model in the tank. After much complacent official conservatism had been overcome, the admiralty finally loaned for this work her majesty's ship Greyhound of 1,157 tons, and her majesty's ship Active of 2,087 tons. In the trials the Active towed the Greyhound at the end of a spar forty-five feet in length, so that all interference and resistance due to the leader's wake might be eliminated. The experiments were successful.

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SCHOOLSHIP ST. MARY'S, OF NEW YORK.

Built for U. S. Navy in 1844. Displacement, 1,025 tons.

Among other facts discovered was the astonishing loss of energy in the steam propulsion of that day. By comparing the indicated horse power of the Greyhound on her official trial with the actual resistance shown by the dynamometer during the towing experiments, and, after making all allowance for opposing conditions, notably for the "slip" (the work lost by a screw turning in a yielding instead of a solid medium), it was found that only 45 per cent. of the power exerted by the steam was usefully employed in propelling the ship. The wasted 55 per cent. was finally debited to the friction of the engines and of the screw and to the detrimental reaction of the screw on the stream lines of the water rushing on and up and around the stern of the vessel. When it is remembered that under the most favorable conditions only about 10 per cent. of the available coal energy was developed in steamers of that day, the rest going up the chimney or into the machinery spaces, more than half of this was dissipated, and that, as a consequence, the working value of one hundred pounds of coal became in propulsion a trifle less than the value of four pounds, it must be conceded that the British admiralty was not getting good money for very exacting and costly labor.

Then, too, the trials and subsequent experiments showed how false the old beliefs were concerning the real action of a ship in the water. By rule of thumb practices, based upon dull tradition, it was held that the resistance of a ship consisted essentially of the force employed in driving the water clear of her as she lumbered on her foaming way. Even in these wiser days the inexpert insist that resistance is the force exerted to excavate a channel along the chosen pathway of the ship. Froude soon demonstrated the inexactness of the old belief, and crystallized the deductions from his own experiments in laws, where the total resistance met was divided into three elements: First, wave making; second, skin friction, and third, eddy making. His discoveries in this field were immediately accepted, and his formulae were stamped with the approval of mathematicians and physicists, notably his two famous enunciations, that wave making controls at high speed and that skin friction constitutes the main resistance at low speed.

Briefly summarized, his methods of investigation have established the

resistance for a model of any given form, and by the law of comparison the resistances of a ship of similar form. In practice each model is driven through the water at successive, appropriate and uniform speeds. During this run a dynamometer furnishes automatic and accurate records of the resistances encountered and of the speed made. In order to render the separate and the successive results intelligible and easy to employ, a curve known as the "curve of resistance" of any particular model is laid down graphically. This curve expresses for a model of particular form the law of its resistance in terms of its speed. By means of previous experiments the force necessary to draw one square foot of the model's immersed section, or "wetted skin," was known. If, then, the number of square feet of immersed skin in the model is calculated, the total skin resistance may be found by multiplying the force required for one square foot by the total square feet of immersed area.

If on the curve of skin resistance be laid a second curve representing the whole resistance at low speeds it will be seen that these two curves are practically identical. On this similarity has been based Froude's first law—that the resistance of tolerably fine ships moving at moderate speeds is almost wholly due to surface friction, or to the friction due to the particles of water that rub on the immersed surface. When a model is made to move speedily it is noticed that a train of waves is put in motion and that the size of these waves increases with the velocity of the model. After constructing the curve of resistance at high speeds and comparing it with that of low speeds it will be found that the former has risen—indeed, in some cases it has shot—much above the curve of low speed or skin resistance. This indicates the entrance into the problem of a new force, and it is now accepted that this excess in great degree measures the force exerted in that "wave making" which at high speeds is the most important resistance evolved.

In these experiments the instruments employed were, first, a tank or basin, sufficiently long for the models to attain the requisite uniform speed; second, "an exquisitely devised apparatus," as an enthusiast terms it, to record automatically with electric contacts the speed and resistances of the models, and, third, the tank models.

The experimental tank of the Denny firm at the Leven ship yard is 300 ft. long, in 250 ft. of which length it is 22 ft. broad and 10 ft. deep. The remaining 50 ft. of length, divided into two shallow docks, one at each end, are used for ballasting, trimming and handling the models conveniently. A double line of rails, 3 ft. 4 in. apart, is carried on suitable beams and girders over the fore and aft center of the tank, and two carriages, one known as the dynamometer truck and the other as the screw truck, are drawn on these rails by means of an endless wire rope that is moved by an ordinary two cylinder engine.

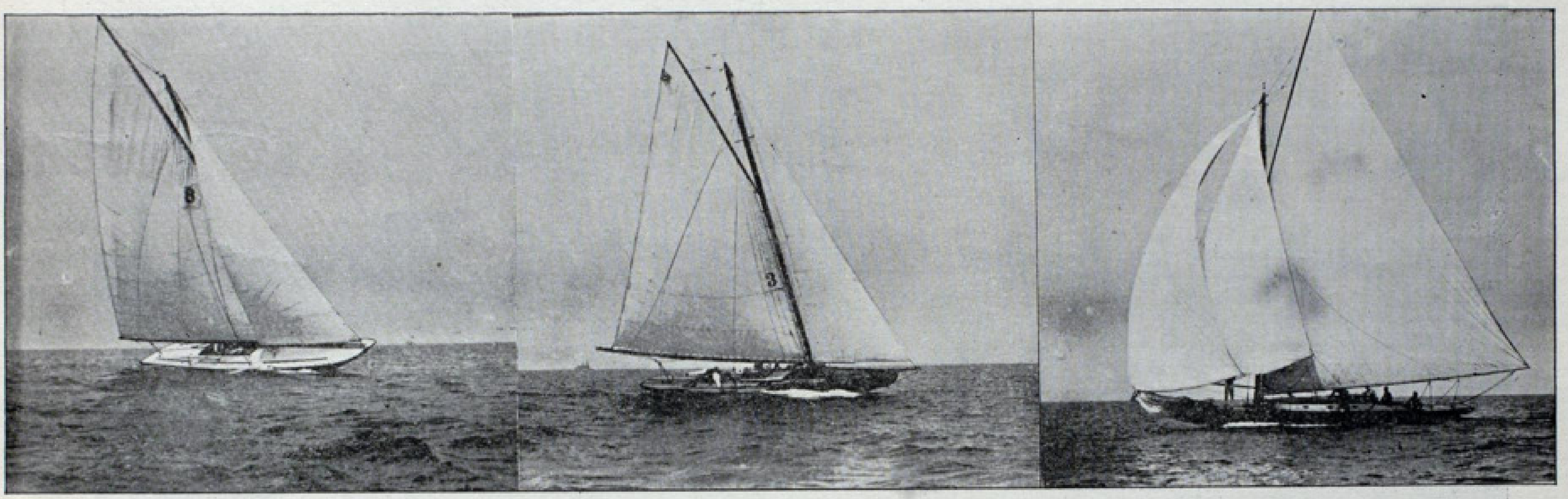
The dynamometer truck is used to ascertain the resistance of the model; the screw truck to record the thrust of the screw, the number of screw revolutions, the slip of the screw and the turning force needed to drive the screws. These instruments are all extremely delicate. The levers are hung either on knife edges or on flat springs, and the wheels in the screw truck work on ball bearings or over Atwood pulleys. The precision and delicacy of these instruments must be extreme, because the quantities dealt with, especially at low speeds, must be measured within one-tenth of one per cent.

NEW SHIP BUILDING PLANT AT CHESTER.

Philadelphia, Pa., Aug. 14.—Within a very few days it is expected that the plans of the incorporators of a company said to be capitalized at $3,000,000 to build ships on the Delaware river, will be made public. It has been generally known for several weeks in this vicinity that a new plant was proposed for Chester, Pa., 12 miles below this city, but the promoters have been so reticent concerning details that came to light regarding the scope of the scheme.

The land optioned consists of from fifty-five to sixty acres on the river front in the heart of Chester. It has a water front of about 2,400 ft. and at present is clear of obstructions. The depth of water in front of the property is from 20 to 25 ft. on the bulkhead line, allowing vessels of the largest size to be docked without much dredging. About thirty acres of the land is owned by the River Front Improvement Co. of Chester, which is composed of many of the most influential citizens of that place, including John B. Roach, president of Roach's ship yard; J. Frank Black, president of the Chester National bank; W. C. Sproul, president of the Seaboard Steel Casting Co.; Josiah Smith, district attorney, and several others. One of the leading factors in the new concern is Senator W. C. Sproul of Delaware county, who represents the largest investors. The Arthur Sewall estate, which has a controlling interest in the Bath Iron Works of Bath, Me., will be the largest single stockholder in the new corporation, and this interest will be represented by Arthur Sewall, Jr., executor of the estate.

It is said that the formation of this new concern will mean the consolidation, or at least the working in harmony of the Wetherell Engine Building Co. and the plate and steel industries of Chester. A yard such as is contemplated will give employment to 1,500 men when running at its normal capacity, and this number will easily reach 2,000 if the yard is fortunate in securing contracts. It is claimed by those close in touch with the enterprise that $2,600,000 of the stock has already been subscribed. Chester possesses many advantages as a ship building site. The river is practically open for twelve months in the year and the work can always be carried on. Almost in the proposed new yard is the plant of the Tidewater Steel Co., which makes all kinds of steel castings and plates, and within easy reach is the large engine building works of the Wetherell Machine Co. and those of the Chester Steel Castings Co.



Milwaukee. Illinois. Cadillac.

OF THESE THREE YACHTS THE CADILLAC WAS SELECTED TO CONTEST FOR THE CANADIAN CUP.

ARMOR PLATE SUCCESSFULLY TESTED.

Two successful tests of armor plate, one for the battleship Maine and the other for a Russian vessel, were conducted at Indian Head last week. The American armor tested was a 6-in. Krupp plate, representing the first group of such armor manufactured by the Bethlehem Steel Co. for the new battleship. Three shots were fired from a 6-in. gun at a velocity of 1,900 ft. per second. All the projectiles were broken on impact. The plate showed a very high resisting quality and proved equal to any ever tested at the proving grounds. As a result of the test the group of armor plate, representing about 400 tons, designed for the Maine, which is now building at Cramps, Philadelphia, will be shipped there immediately. The Russian test was of a 10-in. Krupp plate manufactured by the Bethlehem Steel Co. for the Russian government, representing a group of armor of 300 or 400 tons, intended for the Russian imperial vessel Emperor Alexander III. At this plate three shots were fired from a 10-in. gun with a velocity of 1,739 ft. seconds. The plate was highly satisfactory, and the plate bore every evidence of fully meeting the requirements.

The Harlan & Hollingsworth Co., Wilmington, Del., launched the new steamship Pathfinder this week.

OUR TRADE WITH GERMANY.

Recent discussions regarding the commerce between the United States and Germany lend especial interest to some figures just presented by the treasury bureau of statistics, which show the growth of commerce between the two countries in the last thirty years, and in detail during the last ten years. These figures show that imports into the United States from Germany have increased from $27,000,000 in 1870 to $100,000,000 in 1901, and that exports from the United States to that country have increased from $42,000,000 in 1870 to $191,000,000 in 1901—an increase of nearly 300 per cent. in imports from Germany and of nearly 400 per cent. in exports to Germany. On the export side, the greatest growth has been during the last five years, in which time our exports to Germany have doubled, being in 1896 $97,897,197, and in 1901 $191,072,252. This growth is distributed among a large number of articles. Comparing our exports to Germany in 1895 with those of 1901, corn has increased from $1,672,539 in 1895 to $17,305,229 in 1901; wheat, from $1,522,736 to $7,871,573; lard, from $8,018,516 to $13,700,875; oil cake and oil cake meal, from $2,339,885 to $5,242,624; flour, from $740,264 to $2,011,259; agricultural implements, from $556,914 to $2,677,319; and copper, from $1,604,390 in 1895 to $7,785,496 in 1901. Machinery of all kinds, including steam engines, increased from $1,595,135 in 1895 to $8,109,095 in 1900, the figures for 1901 in this item being not yet available. On the import side, the articles which show the greatest growth during the last decade are coal tar colors and dyes, chemicals, laces and embroideries, earthen, stone and chinaware, and sugar. Coal tar colors and dyes have increased from $1,272,275 in 1891 to $3,822,162 in 1900; other chemicals, from $1,868,988 to $3,968,116; laces and embroideries, from $945,186 to $2,402,372; earthen, stone and chinaware, from $1,475,057 to $2,787,163; and sugar, from $7,209,150 to $12,346,734.

An examination of the statistics issued by the German government shows that articles from the United States formed in 1891 10.4 per cent. of her total imports for consumption, while in 1900 they formed 16.9 per cent. Of her exports, those to the United States in 1891 formed 10.7 per cent. of the total, and in 1900 9.3 per cent.

TRIAL TRIP OF SHALLOW-DRAUGHT GUNBOAT TEAL.

MESSRS. YARROW & CO. HAVE SUCCEEDED IN OVERCOMING MANY PRACTICAL DIFFICULTIES IN THE LITTLE VESSEL.

The British admiralty last year contracted with Messrs. Yarrow & Co. of Poplar, England, for the construction of two shallow-draught gunboats very similar to the Sheikh and Sultan, which the same firm built four years since for the Egyptian government for service on the Nile. These vessels, it will be remembered, played an important part in the taking of Khartoum, and the subsequent expedition to Fashoda. At about the same period as the Sheikh and Sultan were ordered, the admiralty also contracted with Messrs. Yarrow & Co. for the construction of a flotilla, six in number, of similar vessels for the rivers in China and the interior of Africa. These six vessels were named as follows: Heron, Jackdaw, Snipe, Sandpiper, Nightingale and Robin, and they have been doing excellent service.

The problem placed before Messrs. Yarrow & Co. was to obtain a speed of 13 knots (which is equivalent to 15 statute miles an hour), burning wood only, carrying a load of 40 tons on a draught not exceeding 2 ft. 3 in., all the machinery and fighting spaces being protected by rifle-proof plating. Those who are familiar with naval construction will be aware that the conditions to be conformed to present many practical difficulties. These have been successfully overcome, and when Messrs. Yarrow have completed their contract they will have the honor of adding two more vessels of a special type to the British navy, the names of which are the Teal and Moorhen, and the dimensions are as follows: Length, 160 ft.; beam, 24 ft. 6 in.

A partial description of these vessels was given two weeks ago, but the Review is now enabled to give a more thorough one.

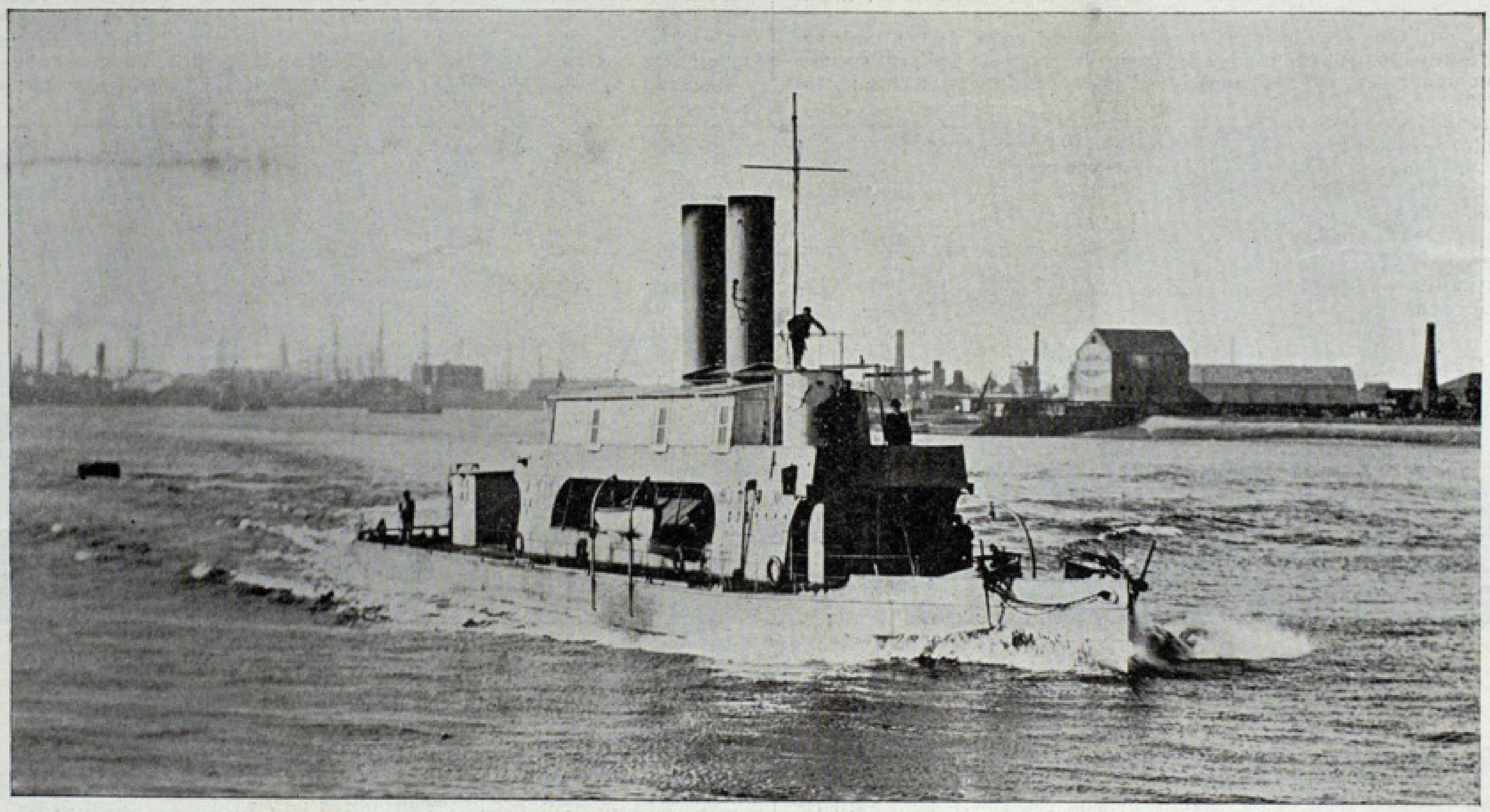
The system of propulsion selected is that of twin screws revolving in tunnels of a special design, so arranged that, although the propellers do not pass below the bottom of the hull, they are of a large and efficient diameter, and work in solid water. The result of the trials show that they have an exceedingly good propulsive efficiency. Doors are placed immediately over the propellers, so that they can be examined or removed without difficulty while the vessel is afloat, thus avoiding the necessity of going into dry dock or hauling the boat up a slip way, should it be required to gain access to the propellers.

As evidence of the accessibility of the propellers, it may be stated that it requires only twenty minutes to remove a propeller and replace it by another.

The first of these vessels, H. M. S. Teal, was recently launched, with steam up, and immediately proceeded down the Thames for a preliminary trial. Five days later the official trial took place. The admiralty were represented on this occasion by Mr. Cotsell and Mr. Adams of the ship department, and Mr. Spyer and Mr. Harding of the engineers' department. These results are exceedingly interesting, and they may be looked upon as unique in the annals of naval construction, a speed of over 15 statute miles an hour being obtained when burning wood fuel only and without the necessity of resorting to the forced draft appliances which were provided, and this result was combined with a draught of 2 ft. 2¼ in., carrying a load of 40 tons, independent of the weight involved by the protection against rifle fire over a large area of the vessel.

After the six runs on the measured mile a three hours' trial was proceeded with, the mean revolutions being 282.6, equal to 13.033 knots, equal to 15 statute miles, as the mean speed for the three hours. During one hour wood fuel only was used and forced draft was not resorted to, the fan being kept slowly revolving for the sake of ventilation only. The hull is built entirely of galvanized steel. It is sub-divided into ten water tight compartments, each compartment being floatable and independent of the others. This system of construction was introduced by Messrs. Yarrow & Co. in the year 1883, when they built for his majesty the King of the Belgians the stern wheel steamer Le Stanley for exploring the Congo. After Le Stanley was built the advantage of this system of construction was recognized, and it was adopted in the case of the Mosquito and Herald, built for the British government for the Zambesi, and also in similar vessels for the French and Russian governments. The benefit of this floatable section system of construction is that it enables the vessel to be put together while afloat, thus avoiding the tedious process of riveting up and launching in distant parts, where skilled labor may not be obtainable. The main deck is of steel, covered with corticine Above is an upper or battery deck, extending for about half the length of the vessel, on which are mounted quick-firing guns and Maxims. Above the battery deck is the awning deck, from which are swung the hammocks for the troops. The battery deck being completely housed in spacious quarters are thus formed for the Europeans. The sides of the vessel in way of the machinery, as well as the cabin accommodation and the bulwarks round the battery deck, are throughout of chrome steel by Cammell, and the plates are of sufficient thickness to be proof against rifle fire, point blank, at close quarters. A conning tower is placed forward on the battery deck and is also rifle proof.

The general fittings of these gunboats are very complete, including accommodation for the native crew, also a specially fitted sick bay. The officers are accommodated in cabin between the main and battery decks. These are loop-holed for rifle fire. The forward cabin is divided into a ward room and commander's cabin, and fitted up for the accommodation of three officers, the after cabin being adapted for eighty petty officers. Passing through these cabins are ammunition hoists, so that there is a direct passage from the magazines below to the battery deck, under cover and protected from shot.



THE SHALLOW-DRAUGHT GUNBOAT TEAL ON HER TRIAL TRIP.

Built by Yarrow & Co., Poplar, England.

The machinery consists of two sets of compound surface condensing engines, running at an average of about 300 revolutions per minute. Steam is supplied by two of Yarrow's patent straight tube water tube boilers, the design of which is now so well known that it need not be described here. The boilers have been designed so that full speed can be obtained when burning wood fuel only. Forced draft is provided for by means of a steam fan in the stokehold, and, although this was not required to be in operation during the official trials for the purpose of forcing the fire, under some circumstances, no doubt, it will be found of great value when only wood fuel is to be obtained of a very inferior character, or green.

The vessel is steered by means of the usual steam and hand steering gear, which actuates four rudders, so as to ensure exceptional maneuvering qualities when navigating very tortuous rivers. Messrs. Yarrow & Co. have, of late years, made a very complete study of this special design of vessel, so as to secure the most efficient combination of speed with shallow draught, and have introduced numerous improvements since they first seriously took up this form of construction. Hitherto the greatest efficiency has only been obtainable at a given draught; but the builders have introduced and patented a system by which the maximum efficiency can be secured corresponding to any draught which the load carried may involve, rendering this system of propulsion, in consequence, not only applicable for river gunboats, where the load is practically constant, but also for shallow draught vessels for commercial purposes where the weight of cargo is continually varying.

During the run some tests were made of the steering capabilities of the Teal, which were shown beyond question to be something altogether remarkable. The way in which she maneuvered either to port or starboard immediately the helm and the four rudders were put over was astonishing.

FOUNDER OF THE GOVERNMENT LIFE SAVING SERVICE.

Dr. William Augustus Newell, who died at his home in Allentown, N. J., last Thursday, was practically the founder of the life saving service of the United States, if any man may be said to be the founder of that which is really a growth. What life saving service there had been before he became interested in its development was of a private character. The Massachusetts humane society established a station at Cohasset in 1807 but did not receive government aid for many years thereafter. The establishment of the coast survey gave some impetus to the life saving service—that is, it caused the government to turn its attention in that direction. It was Dr. Newell who conceived the idea of shooting a life line from the shore to a stranded vessel. This was the initial step in the establishment of the government service and from it has grown the thoroughly organized system by which more than 100,000 human beings have been rescued from death and many millions of dollars of property saved. Dr. Newell, then a member of the national house of representatives, secured the first appropriation of $10,000 in 1848, for the life saving service on the New Jersey coast. With this money life lines, surf boats, and the more crude appliances were provided, and the innovation, looked upon with incredulity by many members of congress who had voted for the appropriation, was ready for the first call to be made upon it to test its practicability. The call came on Christmas night of the following year, when 301 passengers and seamen were rescued from the stranded bark Ayrshire in the midst of a blinding snow storm. The people of the country read with amazement of this remarkable feat, while every member of congress bowed his head to Dr. Newell and his great idea.

From that day to this there has been no trouble in securing liberal appropriations for the life saving service. From the modest beginning on the Jersey coast, the system has grown until now there are 269 stations along the shore lines of the United States. Of this number 194 are situated on the Atlantic and gulf coasts, fifty-eight on the shores of the great lakes, sixteen on the Pacific coast, and one at the falls of the Ohio, Louisville, Ky.

Dr. Newell's account of the founding of the life saving service is as follows:

"The initial idea of a life saving service came to me in 1840, while I was practicing medicine at Mannahawkin, Ocean county, N. J. A terrific storm had swept the coast for a day and a night, but the following morning broke clear and still. I took a long walk along the beach and saw that the Austrian brig Count Perasto had been wrecked on Long Beach, near Barnegat inlet. The tide had gone out and the wrecked vessel was on dry land and thirteen dead bodies were lying along the beach. The idea there occurred to me, would it not have been possible, had a crew been on watch at this dangerous point, to throw a lifeline to the crew of the stranded ship by means of a bow and arrow or a blunderbuss? The experience of that morning created a deep impression upon my mind and I endeavored to evolve a plan whereby my idea could be put to an actual test.

"On Jan. 3, 1848, I introduced in the national house of representatives the following resolution:

"'Resolved, That the committee on commerce be instructed to inquire whether any plan can be devised whereby the dangerous navigation along the coast of New Jersey may be furnished with additional safeguards to life and property, and that it report by bill or otherwise.'

"The committee never reported; so when the light-house appropriation bill was before the house I offered the following as an amendment:

"'An amendment appropriating $10,000 for providing surf boats, rockets, cannonades, and other necessary apparatus for the better protection of life and property from shipwrecks along the coast of New Jersey, the sum to be expended under the supervision of such officer of the revenue marine corps as may be designated by the secretary of the treasury.'

"The amendment was passed without a dissenting vote. Among the members of the house who voted for this amendment were John Quincy Adams, Abraham Lincoln, Andrew Johnson, Robert Toombs and Thaddeus Stevens. The measure was adopted unanimously by the senate, such members as Henry Clay, Daniel Webster, John C. Calhoun, Thomas H. Benton, Stephen A. Douglas and Jefferson Davis giving it their support, at the same time having little confidence in the practicability of the scheme. President Polk signed the bill cheerfully.

"The first practical result of the new venture was accomplished on the night of Christmas, 1849. The Scottish bark Ayrshire was wrecked at Absecom beach. Lines were thrown to her, surf boats were launched and the entire passenger list and crew, consisting of 301 persons, were brought safely to shore in the midst of a blinding snow storm. This remarkable feat cast aside all past doubts in the minds of the senators and representatives as to the practicability of the scheme, and thenceforth liberal appropriations were voted until we have the perfected system of the present day."

Efforts have been made by others to claim the credit of originating the life saving idea, but Dr. Newell's claims are beyond dispute. Appleton's Cyclopedia, in the William A. Newell biography, says:

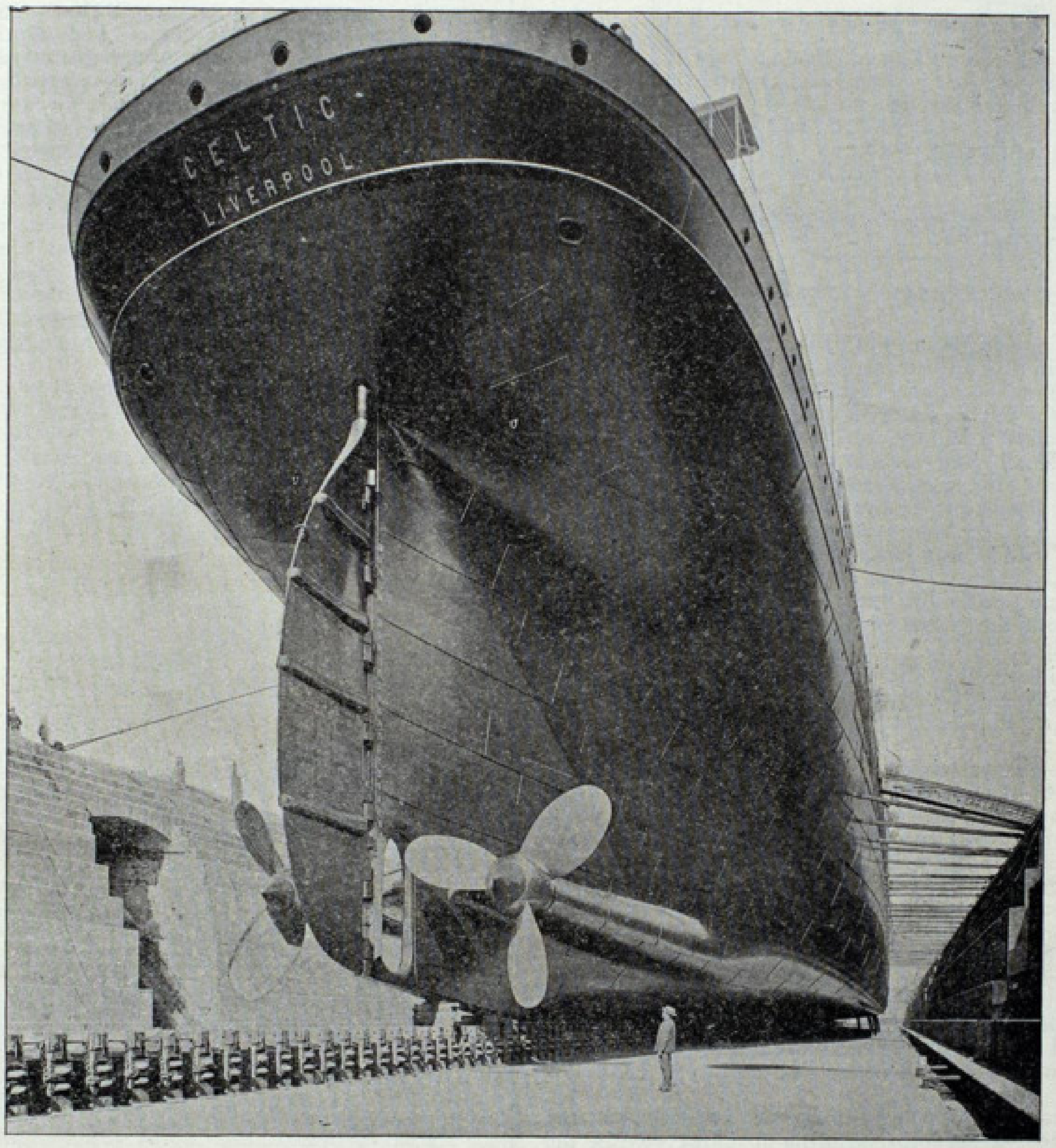
"He originated and procured the first appropriation by congress of $10,000 for the life saving stations on the New Jersey coast, and was superintendent of life saving stations in New Jersey from 1861 to 1863."

Sumner I. Kimball, general superintendent of the life saving service and bureau, says in his report of 1876:

"The government first gave its attention to the method of aiding stranded vessels by the establishment of stations along the coast provided with the means of effecting communication between such vessels and the shore in 1848, and to the Hon. William A. Newell of New Jersey, then a member of the house of representatives, belongs the honor of first advocating the merits of this plan in a speech in which he described the uses of the surf boats, mortar lines, rockets, etc., vividly portraying the horrible scenes of shipwrecks upon the calamitous shores of his state. This appeal, made on Aug. 3, was rewarded by an appropriation of $10,000. More appropriations were made subsequently through the efforts of Dr. Newell until now there are 200 stations and crews, resulting in the rescue of 100,000 persons and saving many millions of property."

Mr. Kimball kindly furnished the Review with a copy of a report which he made to congress in 1898 setting forth Dr. Newell's offices in behalf of the life saving service of the United States. He adds that since the date of his report he has received information from the government of Austria to the effect that the brig Terasto (supposed to be the Austrian brig Count Perasto) was wrecked on the coast of New Jersey Aug. 13, 1839, but that no loss of life attended the disaster. This was in reply to a letter from him requesting particulars of the wreck of the Count Perasto. He infers that the Austrian government has no record of a vessel of that name.

The Largest Vessel in the World.



THE SCREWS OF THE CELTIC OF THE WHITE STAR LINE.
Built by Harland & Wolff, Belfast, Ireland.

EXPORTS TO PORTO RICO.

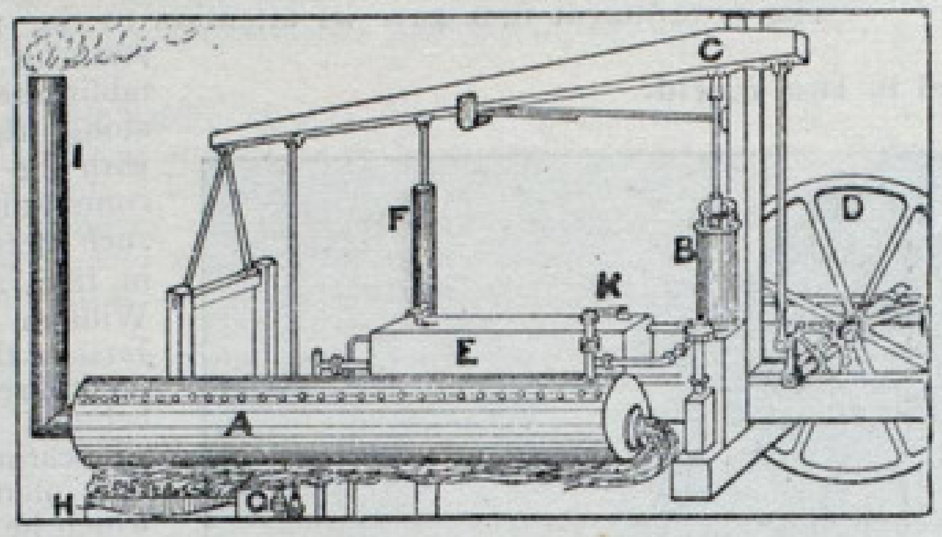
Exports of American products to Porto Rico in the fiscal year just ended were, according to the figures of the treasury bureau of statistics, more than three times as great as they averaged when Porto Rico was under the Spanish flag and more than 50 per cent. in excess of those prior to the enactment of the Porto Rican tariff law which went into effect May 1, 1900. The total domestic exports from the United States to Porto Rico in the fiscal year 1897, which entirely preceded the beginning of hostilities with Spain, were $1,964,850. In the fiscal year 1900, ten months of which preceded the date at which the Porto Rican tariff went into effect, our domestic exports to Porto Rico were $4,260,892. In the fiscal year ending June 30, 1901, all of which was under the Porto Rican act which levied 15 per cent. of the regular Dingley law rates on goods passing into that island from this country, the total domestic exports from the United States to Porto Rico were $6,861,917. These figures include only exports of domestic merchandise and do not include foreign merchandise brought into the United States and re-exported to Porto Rico, which presumably amounted to about $500,000, since the Porto Rican statement of imports from the United States for the fiscal year ending June 30, 1901, shows the grand total including domestic and foreign to be $7,414,502.

Porto Rico imported in the fiscal year ending June 30, 1901, goods amounting to $9,367,230 in value, and of this, $7,414,502 came from the United States, the total from other countries being $1,952,728. Of this $1,952,728 imported from countries other than the United States, the value of $808,441 was from Spain; $374,837 from the United Kingdom; $294,067 from Canada; $166,723 from France, and $152,201 from Germany.

THE EVOLUTION OF THE SCREW STEAMER.

BY BENJAMIN TAYLOR, F. R. G. S.

Who invented the screw propeller? Lindsay, the author of the "History of Merchant Shipping," says it is impossible to ascribe the invention to any one man, as the subject had engaged the attention of so many men for upwards of a century. But it is possible, notwithstanding Lindsay, to get a little nearer than he did to the origin of this now common object of the ocean. The New Jersey has been sometimes described as the first screw propelled vessel in America. She was an iron vessel, built by Laird of Birkenhead in 1838, and originally called the Frank R. Stockton, after her owner, who sold her to the Delaware & Rariton Canal Co. But Stockton took the idea from Ericsson, to whom, indeed, he gave the commission to design the engines after he had watched the operations of Ericsson's experimental boat, the Francis B. Ogden, on the Thames. To John Ericsson, Pettie Smith, and Bennet Woodcroft has been ascribed equal credit for actually putting the "screw" into working order. Let us look into the matter a little further, however, without going into ancient history, as John McGregor did when he endeavored to find the origin of the screw propeller in China!



THE FIRST AMERICAN STEAM ENGINE, 1801.

In one part of his "History" Lindsay says that, "In May, 1804, Mr. J. Stevens of the United States put to sea with a steam-boat propelled by a screw, turned first by a rotatory engine, and then by Watt's reciprocating engine; and as this small craft steamed from Hoboken to New York she has by some writers been considered the first sea-going screw of which there is any certain account." But further on he says, "The screw which Mr. Stevens used in his boat cannot have been of a practical character, or the Americans would not have allowed so valuable an invention to lie dormant for 35 years." That is to say, Stevens's voyage was made in 1804 but the New Jersey did not appear in American waters until 1840, and even then from the hands of English ship builders, with engines designed by a Swede.

Nevertheless, there is evidence that the screw propeller put in operation by Colonel John Stevens on the Hudson river between 1802 and 1806 was actually the first of the kind to navigate the waters of any country.

This Col. John Stevens was certainly a very remarkable man. He was born at New York in 1749, graduated at King's college, was admitted to the colonial bar in 1772, and was treasurer of the state of New Jersey during the war of independence. Afterwards he purchased the island of Hoboken and lived there until his death in 1838. In 1791 Stevens took out three patents for improvements in the steam engine, one of which had reference to a method for propelling a vessel by the reaction of water. In 1798 he was engaged along with the elder Brunel and some others in a series of experiments in steam propulsion on the Passaic river in New Jersey, and among the many things they tried was an elliptical paddle-wheel. But in 1794 a patent was granted to one William Lyttleton, in England, for a screw propeller worked by manual labor with an endless rope. This screw was tried on the Thames, and gave a speed of two miles an hour—a little fact which seems to have escaped even Lindsay's lynx eye.

Lindsay only briefly refers, in a couple of lines, to a patent taken out by Edward Shorter in 1800 for "a perpetual sculling machine having the action of a two-bladed propeller." But, as a matter of fact, Shorter had two schemes. One was a sort of duck-foot paddle, the pair working alternately; and the other was a two-bladed screw at the end of an inclined shaft from the deck of the vessel. With the latter he propelled a heavy transport at the rate of 1½ miles an hour—eight men working the screw at a capstan. But long before either Stevens or Shorter or Lyttleton, viz., in 1752, Bernouilli, the mathematician, elaborated a plan for propelling a boat by means of a screw worked by hand.

The idea of the screw propeller, then, did not originate with John Stevens, though quite possibly he may not have heard of either Bernouilli's or Lyttleton's inventions. But, as far as we can gather, Stevens seems to have been really the first who applied steam as the motive power. He began his experiments in 1801, and he had a screw steamer on the Hudson river in 1802—not in 1804 as mentioned by Lindsay. He tried a succession of non-condensing engines between 1801 and 1804 and it is interesting to note, he got a high pressure of steam out of multitubular boilers, for which he had taken out a patent. And he used not a two-bladed but a four-bladed screw.

In a letter to a New York Journal in 1812, Stevens thus wrote an account of his experiments:

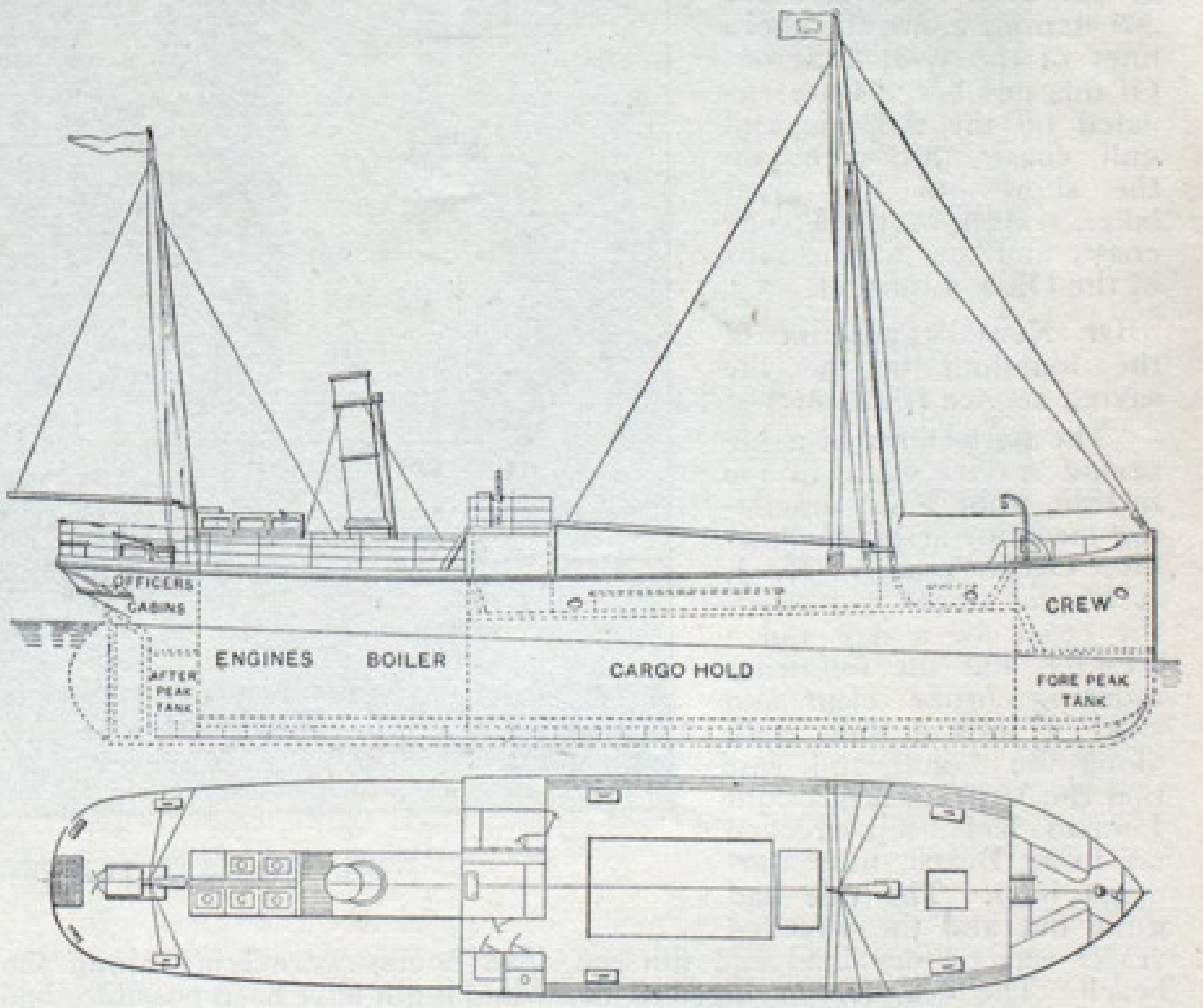
"To avoid the mischievous effects necessarily resulting from the alternating stroke of the engine of the ordinary construction, I turned my attention to the construction of steam engines on the rotary principle. And the first steamboat put in motion on the waters of the Hudson was one constructed on this principle. * * For simplicity, lightness and compactness, the engine far exceeded any I have yet seen. A cylinder of brass, about 8 in. in diameter and 4 in. long, was placed horizontally on the bottom of the boat, and by the alternate pressure of the steam, on two sliding wings, an axis passing through its center was made to revolve. On one end of this axis, which passed through the stern of the boat, wings like those of the arms of a windmill, were fixed, adjusted to the most advantageous angle for operating on the water. This constituted the whole of the machinery. Working with the elasticity of the steam merely, no condenser, no air pump, was necessary, and as there were no valves, no apparatus was required for opening and shutting them. This simple little steam engine was, in the summer of 1802, placed on board a flat-bottomed boat I had built for the purpose. This boat was 25 ft. long and about 5 or 6 ft. wide. She was occasionally kept going until the cold weather stopped us. When the engine was in the best order her velocity was about four miles an hour. I found it, however, impracticable on so contracted a scale to preserve due tightness in the packing of the wings in the cylinder for any length of time. This defect determined me to resort again to the reciprocating engine."

Here are chapter, verse and date in the inventor's own words, and never, so far as we know, called in question. In referring to his 1803 experiment, Stevens has written as follows:

"I constructed an engine although differing much from those described in the specifications of my patents, yet so modified as to embrace completely the principle stated therein. During the winter this small engine was set up in a shop I then occupied at the Manhattan works, in Duane, near Centre street, and continued occasionally in operation until spring, when it was placed on board the above-mentioned boat, and by means of bevel cog-wheels it worked the axis and wings above-mentioned, and gave the boat somewhat more velocity than the rotary engine. But after having gone some time, in crossing the river with my son on board, the boiler, which was constructed of small tubes inserted at each end into metal heads, gave way so as to be incapable of reparation." (Note here, also, the germ of the tubulous boiler.)

In the following year Stevens adopted Watt's "reciprocating rotative" engine, with a 4½-in. cylinder and 9-in. stroke, working a two-bladed screw, with which he got a speed of about four miles an hour. It was probably this vessel and engine that Prof. Renwick of Columbia college saw, as related in an interesting letter which has been published in the Journal of the New York historical society. Prof. Renwick wrote in 1858:

"The first time that I ever heard of an attempt to use steam for propelling vessels was from a classmate of mine who resided during the summer months at Belleville, in New Jersey. He had, in the summer of 1803, seen an experiment on the Passaic river, which he stated to have been directed by John Stevens of Hoboken. According to his account the propulsion was attempted by forcing water by means of a pump from an aperture in the stern of the vessel(!) From some vague indications



AN EARLY DESIGN OF A BRITISH SCREW STEAMER.

it would appear that the elder Brunel, afterwards so distinguished in Europe, was in the employment of Mr. Stevens on this occasion. In the month of May, 1804, in company with the same young gentlemen and another classmate, I went to walk in the battery. As we entered the gate from Broadway we saw what we, in those days, considered a crowd running towards the river. On inquiring the cause we were informed that 'Jack Stevens' was going over to Hoboken in a queer sort of boat On reaching the bulkhead by which the battery was then bounded, we saw lying against it a vessel about the size of a Whitehall rowboat on which there was a small engine, but there was no visible means of propulsion. The vessel was speedily under way."

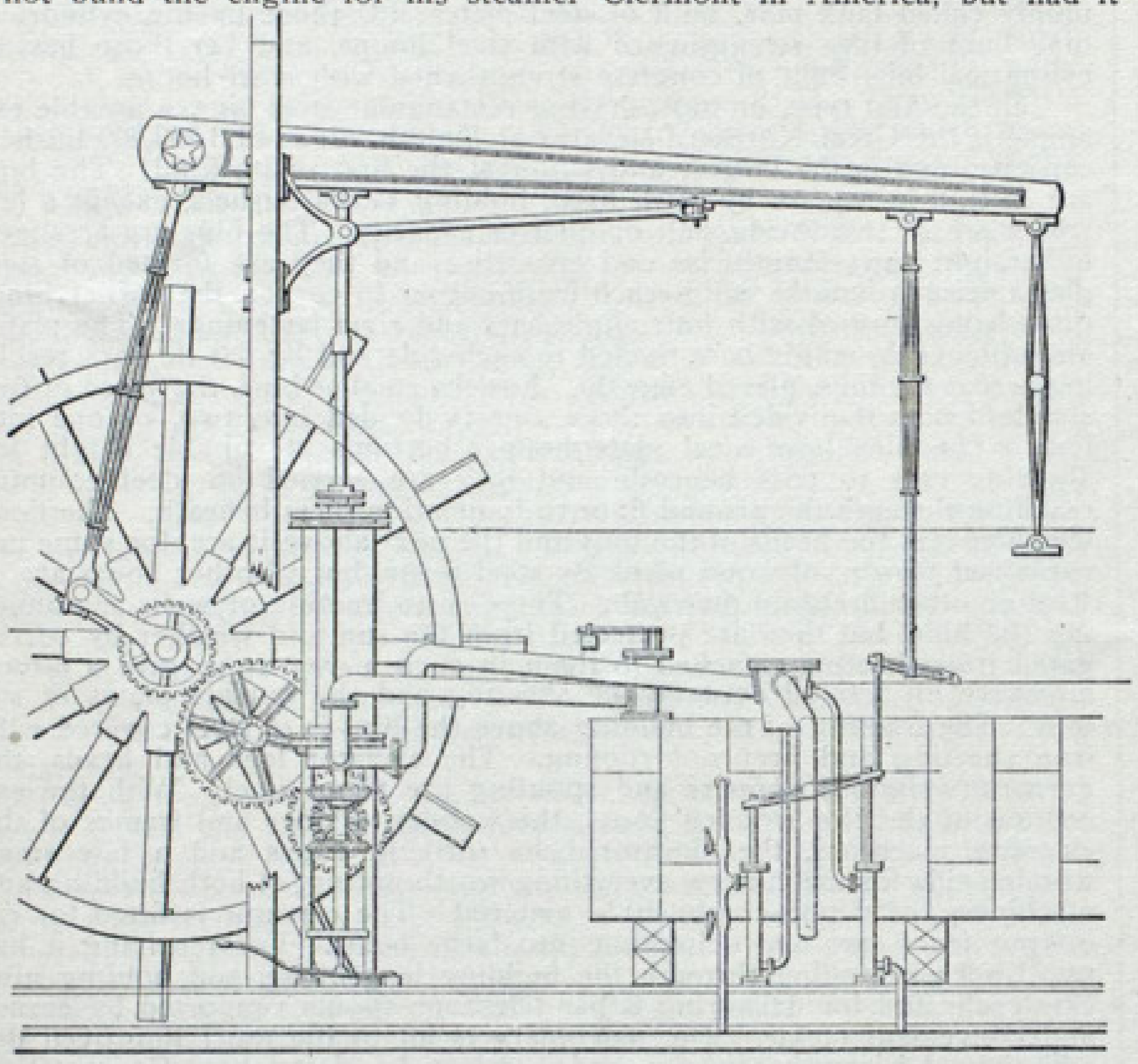
Fifty years later Prof. Renwick recognized, at an exhibition of the American Institute, the boat and engine which he had seen in 1804. They were exhibited by the sons of Col. Stevens. And Renwick himself was an authority on the history of the steam engine, for he contributed the American chapter to Tredgold's celebrated "Treatise."

Now we gather from these records that Stevens was not only the first to devise a screw propeller worked by steam, but that he was also the inventor of the twin-screw, for he found out the well known tendency of a single screw to turn the bow of the vessel. Forty years later, viz., in 1844, this old twin-screw engine, overhauled and repaired, was fitted on board a new boat and again tried on the Hudson river, when a speed of eight miles an hour was obtained. And this same engine, with

its boilers, is still, we believe, preserved in the Stevens Institute at Hoboken.

It is interesting to note that the young man whom Prof. Renwick saw in 1804 acting as coxswain in the queer little boat, was John Cox Stevens (son of the colonel), who in later years founded the New York yacht club, and steered the famous yacht America in her historic race off the Isle of Wight, when she won the international cup in 1851. He was sent over to England by his father to take out an English patent for the invention, and he called upon the famous James Watt with the plans. It is said that Watt objected to the thing, because he did not believe in the practical use of steam at a pressure more than 2 or 3 lbs above the atmosphere. As to this we read, some years ago, in Cassier's Magazine that "At the date of the introduction into use of the screw propeller, 1838, the pressure of steam carried on the boilers of condensing engines of the vessels that now navigate the bays and rivers of the Atlantic seaboard, averaged about 30 lbs. per square inch, while on the innumerable steamboats on the Mississippi and its tributaries the steam averaged 140 lbs. per square inch. At the same time, the pressure on English vessels was the same that Watt had established, viz., 2½ to 3 lbs. The Great Western, in 1838, carried that pressure and the iron screw propeller Great Britain, in 1846, carried only 5 lbs. per square inch."

Col. Stevens continued his experiments with the screw propeller for several years before Fulton brought out his paddle-boat. And it is remarkable that all his ideas have now, after half a century, been applied to steamship navigation, viz., the four-bladed screw, the use of high-pressure steam, the multi-tubular boiler, the direct connection of the engine with the propeller shaft, and the twin-screw. But in Stevens's time there were neither efficient tools nor competent workmen in America to carry his ideas into effect. Fulton, it must be recalled, did not build the engine for his steamer Clermont in America, but had it



AN EARLY BEAM ENGINE.

made by James Watt in England and taken over complete. This was in 1806, and special permission had to be obtained for it from the king in council, because the exportation of machinery from England was then illegal—and indeed remained illegal down to 1820. Stevens cheerfully admitted that Fulton was the first to apply, with practical effect, "water-wheels" to the side of a steamboat, but he adhered to the opinion that, with proper machinery, the screw would always be found superior to the paddle for sea-going vessels.

It was just thirty years after Stevens discontinued his experiments that John Ericsson, the Swedish engineer, submitted to the admiralty a plan for screw propulsion. He constructed a model boat, some 2 ft. long, and by means of a small model engine, fed with steam from outside, showed the practicability of his scheme. Nevertheless, the admiralty, having previously come to the conclusion that the screw was impracticable, rejected his plan, and did not adopt it until after Ericsson had built upwards of forty screw steamers in America.

Ericsson's first test on a full scale was with the Francis B. Ogden, mentioned at the outset of this article. This was a wooden boat, built at Wapping on the Thames, into which he fitted an engine driving two screws, with which he obtained a speed of 10 miles an hour. Just about the time when Ericsson was taking out his patent, Thomas Pettit Smith also took out a patent for driving a vessel by means of a screw, or worm, revolving rapidly under water. He made trial of it in a small six-ton boat, and the experiment was so successful that a company was formed in 1839, called the Steamship Propeller Co., to purchase and work Smith's patent. The result was the Archimedes, a vessel of 237 tons built under the direction of Smith and specially for his screw propeller. Smith expected a speed of 12 or 13 miles an hour, but the Archimedes never developed more than about 9 miles an hour. She was eventually sold at a heavy loss.

Both Ericsson and Smith claimed the invention, but neither, as we have seen, originated the idea. Both took out patents in America, as well as in England, but in neither case were the patents sustained. The Robert F. Stockton was built, in 1838, for Ericsson's screw, but she was sent across the Atlantic under sail. The designs of the inventors were quite different. Smith was well backed and succeeded in getting his screw taken up in England, while Ericsson, not finding favor in that country, went over to the United States. Both Ericsson and Smith eventually abandoned their original plans and adopted the short screw now in use. In Smith's patent the screw was a long single blade, after the model of the Archimedes screw; in Ericsson's patent there were two separate blades, one behind the other. Both were inferior designs to Stevens's, but Ericsson and Smith together revolutionized steam navigation, for from their complicated screws rapidly evolved the propeller now universally in use.

The first screw steamer to cross the Atlantic was the Great Britain (of Bristol) which took some six years to build. She was a vessel of some 3,618 tons, measuring 322 ft. in length, 50 ft. in extreme breadth, and 32 ft. in depth. She had six masts and one funnel, and with the aid of a screw propeller went from Liverpool to New York, in August, 1845, in fifteen days, making an average speed of nine knots. She made several voyages back and forward until September, 1846, when she ran ashore on the coast of Ireland, where she remained stranded for nearly a year. She was floated off in the autumn of 1847, taken to Liverpool for repairs, and then put into the Australian trade. After serving in that trade for some twenty years, her propeller and machinery were taken out, and the first transatlantic screw steamer was converted into a full-rigged sailer. The last stage in her eventful history was as a coal-hulk in the Pacific.

MONTHLY SUMMARY OF NAVAL CONSTRUCTION.

In the monthly summary of naval construction, issued by the bureau of construction and repair, the armored cruiser Colorado at Cramps is the only one of the recent order of eleven battleships and cruisers actually laid down. The protected cruiser Cleveland at the Bath Iron Works, Bath, Me., is 61 per cent. completed and will be launched on Sept. 22. Following is the summary:

Name.	Building at	Degree of completion, Per cent. July 1.	Aug. 1.
	BATTLESHIPS.		
Illinois	Newport News	96	98
Maine	Cramp & Sons	55	58
Missouri	Newport News	39	42
Ohio	Union Iron Works	43	43
Virginia	Newport News	0	0
Nebraska	Moran Bros. Co.	0	0
Georgia	Bath Iron Works	0	0
New Jersey	Fore River Co.	0	0
Rhode Island	Fore River Co.	0	0
	ARMORED CRUISERS.		
Pennsylvania	Cramp & Sons	0	0
West Virginia	Newport News	0	0
California	Union Iron Works	0	0
Colorado	Cramp & Sons	2	3
Maryland	Newport News	0	0
South Dakota	Union Iron Works	0	0
	SHEATHED PROTECTED CRUISERS.		
Denver	Neafie & Levy	49	51
Des Moines	Fore River Engine Co.	39	45
Chattanooga	Lewis Nixon	35	37
Galveston	Wm. R. Trigg Co.	31	33
Tacoma	Union Iron Works	20	20
Cleveland	Bath Iron Works	58	61
St. Louis	Neafie & Levy	0	0
Milwaukee	Union Iron Works	0	0
Charleston	Newport News	0	0
	MONITORS.		
Arkansas	Newport News	60	61
Nevada	Bath Iron Works	89	90
Florida	Lewis Nixon	67	68
Wyoming	Union Iron Works	75	75
	TORPEDO BOAT DESTROYERS.		
Bainbridge	Neafie & Levy	94	95
Barry	Neafie & Levy	88	90
Chauncey	Neafie & Levy	90	90
Dale	Wm. R. Trigg Co.	95	96
Decatur	Wm. R. Trigg Co.	96	97
Hopkins	Harlan & Hollingsworth	75	75
Hull	Haslan & Hollingsworth	74	74
Lawrence	Fore River Engine Co.	99	99
MacDonough	Fore River Engine Co.	98	98
Paul Jones	Union Iron Works	85	85
Perry	Union Iron Works	89	89
Preble	Union Iron Works	87	87
Stewart	Gas Engine & Power Co.	54	55
Truxton	Maryland Steel Co.	68	70
Whipple	Maryland Steel Co.	67	69
Worden	Maryland Steel Co.	67	69
	TORPEDO BOATS.		
Stringham	Harlan & Hollingsworth	98	98
Goldsborough	Wolff & Zwicker	99	95
Blakely	Geo. Lawley & Son	98	98
DeLong	Geo. Lawley & Son	98	98
Nicholson	Lewis Nixon	90	91
O'Brien	Lewis Nixon	94	96
Thornton	Wm. R. Trigg Co.	97	97
Tingey	Columbian Iron Works	68	68
Wilkes	Gas Engine & Power Co.	82	84
	SUBMARINE TORPEDO BOATS.		
Plunger	Lewis Nixon	15	19
Adder	Lewis Nixon	70	75
Grampus	Union Iron Works	51	51
Moccasin	Lewis Nixon	65	70
Pike	Union Iron Works	50	50
Porpoise	Lewis Nixon	60	64
Shark	Lewis Nixon	58	63

Alvin R. Morrison, president of the Delaware Construction Co., of Wilmington, announces that the large dry dock which the company is building for the William Skinner & Sons of Baltimore, will be completed in about three weeks. This dry dock job is the largest contract ever undertaken by the Delaware Construction Co., and much time has been required to do the work. The construction company is now in the hands of receivers, but it is expected that the receivership will be terminated in the near future.

The recently launched battleship Maine was brought from Cramps' ship yard to League Island on Thursday last and put in dry dock. Her huge bulk completely filled the dock and the keel blocks had to be raised 15 in. higher than in ordinary cases to keep her clear of the dock's altars. The ship's bottom is at present receiving one coat of two coats of non-corrosive paint and one of anti-fouling paint. The Maine will be returned to the ship yard about Aug. 18.

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The present week has borne witness to a significant triumph of American manhood. The workman has proved himself to be greater than his union. When Mr. Shaffer issued his amazing call to the amalgamation last week the country was simply astounded at its provisions. This man, supposed to be the representative of American labor, called upon the members of the amalgamation to repudiate their contracts with the United States Steel Corporation. From the moment that call was issued until the day set for it to take effect the American workman was on trial before the bar of public opinion. To his credit let it be said that he declined to obey the call. It is true that there has been some deflection from the ranks but the majority of the American workmen have remained at work. The amalgamated association hoped to bring out one-half of the mills of the Steel Corporation and it succeeded in stopping only one-sixth of its great operating force. Even at that the major portion is unskilled labor which, of necessity, had to be thrown out of employment. The strike is clearly confined to the Pittsburg, Wheeling and Newcastle districts and the gas belt in Ohio and Indiana. The struggle is not likely to spread beyond these geographical limits. The great protest against the unwarranted action of the leader of the amalgamation came from the west. A considerable portion of the members of the amalgamation in Chicago, Milwaukee and Joliet did not accept Shaffer's view of the case. They simply stated that existing contracts forbade their striking. When Shaffer heard of this he said, "I cannot understand the action of our western men, but if it is true that they are at work I will not be satisfied until the men in the slave pens of the trust assert their manhood." Mr. Shaffer has very curious notions of manhood. Moreover his language in referring to the mills as slave pens is scarcely becoming. Most of the men working in them were very glad to get their positions and it has probably never occurred to any of them that they were slaves. They will not welcome the suggestion from Shaffer. These self same mills have been paying the highest wages known in the steel world, and they have, as a general thing, a contented and independent class of workmen.

What is the present situation? There is not a constituent company of the United States Steel Corporation which has not one or more plants in operation in face of the strike order and the largest and heaviest tonnage producing companies are running in full. What is the lesson to be derived from the strike? This is a point that is of as great importance to the workmen as it is to the employer. The country has seen a strike precipitated without just cause. It is because it is so grievously unjust that it is going to fail. The workmen of the country have seen the name of labor attached to the most dishonorable proposition that has ever been presented to a civilized community. With the union as a unit some have indorsed it; but it is inconceivable that with the individual as a unit it could possibly be indorsed by anyone. It is doubtful if Shaffer could find a single adherent. As far as Shaffer has been able to dictate the policy of the union he has said that contracts entered into by the union are binding only upon the employers. They may be revoked at will by the workmen. This is an entirely new view of contracts and that it is entirely at variance with the constitution of the United States, which holds as one of its most precious guarantees the sanctity of contract, does not disturb Mr. Shaffer in the least. It might well disturb the workman, however. Mr. Shaffer in seeking to do a considerable injury to the United States Steel Corporation has succeeded only in doing a very great mischief to the cause of organized labor. He has said in so many words that the amalgamation recognizes no obligation except the obligation to itself. We doubt very much whether the workmen care to subscribe to any such sentiment as that, or indeed to belong to an organization which includes it among its tenets. The lesson is, in the future, to look to the individual workman. After the present experience no employer can be blamed for looking with distrust upon a contract made by the union. He cannot help it. He will look to each man individually. With such a policy as this few contracts will be broken. Shaffer has written the death warrant of the amalgamation.

Senator Frye is planning a meeting of the friends of the shipping bill to be held in Boston during the first week of September. The purpose is to get the bill in preparation for presentation early after the opening of congress and to receive the suggestion of the members as to the best form in which to introduce it. Among the more important matters which will be considered at the Boston conference is a provision in favor of vessels engaged for the greater part of the year in the coastwise trade and which wish to engage in the foreign trade during a portion of the year. The bill will be introduced in the senate by Mr. Frye but it is not yet determined who will introduce it in the house. It is barely possible that the bill may originate in the house for parliamentary reasons. With Pettigrew, Butler and Allen out of the senate, friends of the bill believe its prospects of passage at the next session are favorable.

GRAIN ELEVATORS OF THE GREAT LAKES.

AFTER AN EXHAUSTIVE INSPECTION OF THEM, HARBOR ENGINEER JOHN KENNEDY RECOMMENDS FOR MONTREAL AN ELEVATOR SIMILAR TO THE GREAT NORTHERN AT DULUTH.

The harbor commissioners of Montreal recently made a tour of the great lakes to inspect the grain elevators and terminal facilities. Mr. John Kennedy, the chief engineer of the commission, who accompanied the members, has made the following instructive report upon fireproof grain elevators of the lakes:

The grain elevators examined were in the cities of Duluth, Minneapolis, Chicago, Cleveland and Buffalo, and they comprised examples of all the chief types of elevators of wholly fireproof materials, which are known to have been built, or are being built on this continent. For convenience of description and consideration the elevators examined may be divided as regards bin construction into four types: (1) Those having rectangular grain bins built of steel plates; (2) those having cylindrical bins, commonly called tank bins, built of steel plates; (3) those having cylindrical bins built of tiles strengthened with steel hoops, and (4) those having cylindrical bins built of concrete strengthened with steel hoops.

Of the first type, or those having rectangular steel bins, a notable example is the Great Northern elevator at Duluth. It is of 3,000,000 bushels capacity, and is the largest and amongst the first of its kind. The bins are 14 ft. 9 in. square by 85 ft. high, holding 14,500 bushels, except a few which are of two-thirds, half or quarter capacity. The bins are arranged in straight rows lengthwise and crosswise and they are formed of steel plates of such lengths as to reach from corner to corner, the corner junctions being formed with four angle bars and rivet fastenings. The plates are stiffened by angle bars riveted to each side and by flat tie bars reaching across the bins, placed edge up. For the smaller bins, the space of two standard bins is divided into three, one is divided into two, or one into four. The bins have steel plate hopper bottoms at suitable height for allowing cars to pass beneath, and they are carried on steel columns reaching through the ground floor to foundation piers beneath. The floor which covers the heads of the bins and the next above it are, for some unexplained reason, of wood plank on steel joists, but all other floors are of steel or other fireproof materials. There is no framing or walls surrounding the bins, but they are protected from the sun and weather by corrugated iron sheeting attached to them in such a way as to give a 6-inch air space all around between the sheeting and the outside plates of the bins. The framing of the building above the bins is of steel covered with iron sheeting and fireproof roofing. The elevator legs and heads, the garners, weighing hoppers and spouting are all of steel. With the exception of the two wooden floors, the wooden casings and frames of the cleaning machines, the elevator belts, driving ropes and a few small wooden sills for machinery, everything worth noting, of both building and machinery, is of non-combustible material. The elevator is fitted for receiving from cars and delivering into large boats. For receiving it has two tracks extending through the building lengthwise, and holding nine cars each, and for delivering it has telescope spouts supported by cranes and convenient tackle. The machinery is all of the most improved description and largest capacity, and is driven by electricity. Construction was commenced about two years ago, but owing to delays in obtaining steel and difficulties incident to a novel character of construction, it is hardly yet completed. About a fourth of the bins and machinery have been in use, and are found to work well, and the remainder are very nearly ready for use.

At Minneapolis there are also examples of elevators having square steel bins, in which the square bins are essentially the same as those in the Great Northern elevator of Duluth, but the Minneapolis elevators, as a whole, differ from the Great Northern in having only part of their storage capacity in square bins, and the remainder in round bins. In the Pioneer steel elevator of Minneapolis, for instance, finished about a year ago, and of about 1,200,000 bushels capacity, there is a central working house, which contains the receiving and delivering machinery, which is fitted with square steel bins, but they are of only 200,000 bushels aggregate capacity, and the main storage capacity of the elevator is in ten circular steel bins of 100,000 bushels each, arranged in two annexes of five bins each. The square bins of the Pioneer are built and supported in substantially the same way as those of the Great Northern, but their outer sides stand open to the weather, without walls or sheeting of any kind. In the working house containing the square bins, the ground floor is of concrete and upper house floors, frames and sidings are of steel. Everything about the whole elevator and annex bins is of non-combustible material, except the belts and cleaning machines. Another Minneapolis elevator, of 1,800,000 bushels capacity, under construction, is to be of practically the same construction as the Pioneer, except that the tank annex is to be all at one end and everything but the belts will be non-combustible. Even the cleaning machinery will have steel casings and frames. The elevator is notable as being mainly owned by its builders, who are known as elevator builders of great skill and experience, and who may be considered as building that which their skill dictates as best suited to the requirements of the place, and most likely to be profitable as a venture.

Of the second type of steel elevators, or those having circular bins of steel plates, amongst the early examples are the electric elevator at Buffalo, and the Canadian Pacific railway elevator at Fort William, Ont. Later examples are the Great Northern of Buffalo, and the storage annex of the Pioneer steel elevator at Minneapolis; and the latest are the American Linseed Co.'s, and the Buffalo Elevating Co.'s elevators under construction in Buffalo, and the annex of another under construction in Minneapolis. In all of these, except the Great Northern and the Buffalo

Elevating Co.'s, under construction in Buffalo, the bins are simple cylindrical tanks built of steel plates, and placed in rows with their bottoms at ground level. The grain is taken in from grain boats or cars by machinery placed in a house at the end of the rows or groups of bins, and is sent to the bins by overhead conveyors which carry and drop it into any desired one. Beneath each row of bins is also a conveyor by which the grain is carried from any bin back to the working house, where it is elevated and shipped or restored as may be desired. The bins are roofed overhead, but the sides are not covered. In the Buffalo examples, the bins are of various sizes, but in those at Minneapolis they are all of about 50 ft. diameter and 100,000 bushels capacity each. In the Great Northern elevator of Buffalo, the circular bin system is quite differently treated. In it the bins are all supported on steel columns with their hopper bottoms at about the usual spouting height above the ground floor, and the elevator legs and working machinery, instead of being all at one end, is distributed throughout the house, and the grain is spouted from the bins to the boots, and from the heads to the bins as in ordinary elevators. There are thirty circular bins of about 39½ ft. diameter, and 75,000 bushels capacity each, and in their interspaces are twenty-seven circular bins of about 15½ ft. diameter and 12,000 bushels capacity. A number of the irregular shaped interspaces formed between the small and large cylinders, have been further utilized by connecting the cylinders by steel plates, thus making little bins of about 2,000 bushels capacity. The bins are housed around by steel framing and sheeting, and are surmounted by the usual upper stories and cupola for containing the elevator heads, spouting, weighing hoppers, etc. The elevator has a storage capacity of about 2,600,000 bushels, and is fitted for receiving from boats and for delivering to cars on tracks outside the house. In the elevator of the Buffalo Elevating Co. (practically the Lehigh Valley Railroad Co.), the round steel bin system is being skilfully used in still another way. It is yet in the early stages of construction, but it is intended to be a working and storage house for receiving from lake boats and delivering into canal boats and cars. The circular bins are supported on steel columns, with their bottoms at spouting height above the ground floor. They are 15½ ft. in diameter by about 70 ft. high, and placed a foot apart, which gives circular bins of about 10,500 bushels capacity and interspaces of about 5,000 bushels capacity, which are utilized as bins.

The third type of fireproof construction, or that in which the bins are of tiles, has thus far been used only for storage annexes, and the only examples seen are two in Minneapolis. In these the bins are circular, of 50 ft. diameter and 100,000 bushels capacity each. Their bottoms are at ground level, on concrete foundations, and they are filled and emptied by conveyors overhead and underneath. The walls of the bins are of specially molded glazed hollow tiles laid in two thicknesses, with steel hoops built in to resist the internal pressure of the grain. Only the inside of the bins is used for storage; the interspaces are not utilized.

Of the fourth, or concrete type, there is only one example, and that is an unfinished elevator at Duluth. The bins proper are being built of circular form, and in rows at about 4 ft. clear distance apart, with connecting walls to separate the interspaces, which are also intended to be utilized, are of about 30,000 bushels capacity each. The walls of the bins are of high class concrete, 12 in. thickness at the lower part and about 9 in. at top, and they are strengthened by steel hoops and diagonal wire lacing, built in. The bins are being roofed over, but they are to have no housing around them.

It is obvious, on considering the main characteristics of the elevators described, that the new materials which have been adopted in order to make them fireproof have in great measure governed the larger features of the elevators as well as the details of construction. When wood alone was used the rectangular plank bin was so clearly the best that no other was used, and the limitations of the material and mode of construction practically limited the general arrangement to groups of rectangular bins of 15,000 bushels or less capacity each. Bins of such material and sizes have the advantage of suitability for the storage of grain of all sorts and conditions, and lots of all usual sizes; but being of inflammable material, the risk of fire made it prudent to keep the aggregate capacity of the group, or single elevator building to something like a million bushels. On the other hand, steel, the first and most generally adopted material for wholly fireproof elevators is best suited to the construction of bins of large size, of say 100,000 bushels capacity, and of circular shape, and being fireproof they may be safely grouped to give any required aggregate capacity. In early examples of steel elevators the bins were therefore made circular, chiefly of large capacities, and with bottoms at ground level, but this arrangement is unsuited to the storage of grain in small lots, and it involves the use of grain handling machinery of very limited capacity, and gives limited freedom in changing heated grain from bin to bin. Its main advantages are economy of construction and freedom from fire risk. An improvement in the circular bin system which eliminates some of its most serious defects was that adopted in the Great Northern at Buffalo by raising the bottoms of the bins to spouting height above the ground, putting small round bins in the spaces between the large and making bins of the remaining interspaces, and by suitably increased working machinery of ordinary type. A still further and, for most conditions, the best development of the circular bin system, is that on the Buffalo Elevating Co.'s elevator, in which the bins are only about 11,000 bushels capacity, each with utilized interspaces of about half the capacity, and all at high level so as to be served by ordinary working machinery. While the circular bin system was being thus developed a more radical departure was made in the use of steel by discarding the circular bin altogether and reverting to square bins of moderate size, placed at high level, and served by ordinary machinery enclosed by steel housing, or in other words, in using steel in such a way as to make an enlarged and improved copy of the best features of wooden elevators, while avoiding their inflammability. A compromise type suited to certain requirements, and of moderate cost, is that of the Pioneer elevator in Minneapolis, in which there is a working house with square steel bins of convenient size, and an annex of large circular steel bins to make up the total required storage capacity.

The tile and concrete systems are obviously the outcome of efforts to obtain suitable materials other than steel plates for the construction of incombustible bins. Thus far the bins under both systems have been only of large size and circular form and seated at ground level, and they have therefore the same limitations as to use as have steel bins of the same size and form. As regards the action of the various fireproof materials upon the grain in contact with them and the sufficiency of the materials to bear the strains of service, experience is short, but so far as it goes indicates that none of them do any harm whatever to the grain nor are they harmed by grain in any condition. It was at one time feared that steel bins might sweat or heat the grain, but nothing of the kind has taken place. For the resisting of load strains steel bins can of course be made of any required strength, and tile bins as built and used have proved to be of ample strength. Some of the newly built concrete bins at Duluth failed on a test made by filling an interspace with grain, but the failure has not deterred the owners and builders from continuing the building of the other bins required to make up the full intended number.

In applying the information thus set forth to the case of the proposed Montreal harbor elevators, the following are the main questions which arise and the ways in which, in my judgment, they should be met. The questions are, for convenience, worked out for one elevator of 1,000,000 bushels capacity, but the reasoning is applicable to other capacities and more elevators.

1. As to whether the elevator building be built of wood or of fireproof materials. The question obviously touches both the owner and the user, and its solutions as regards both may be made on the following assumptions: A million bushel wooden elevator will cost, without wharf conveyors, say $300,000, and its insurance rate may be taken at about 2½ per cent. One of fireproof materials will cost about $400,000, and on it there need be no insurance. The interest on first cost will be, say, 3½ per cent. per annum, and alike for both kinds of elevators. An elevator like all other plant used in trade will soon become obsolete because of changing conditions, and must be practically rebuilt or replaced long before worn out. A renewal fund should therefore be set aside, which, at say 3½ per cent. yearly compound interest, will provide for total renewal in say twenty-five years. Such renewal fund will be equal to 2.9 per cent. per annum on the first cost. Maintenance and working expenses will about balance in the two kinds of buildings, and need not be taken into account. The average storage term of grain taken into the elevator for storage during navigation season, apart from that merely transhipped, may be taken at ten days; and the grain insurance rate for that term in a wooden elevator may be taken at 0.25 per cent. Probably no insurance need be carried on grain in fireproof elevator, but in case it should be required by banks making advances it would be about 0.05 per cent. For winter storage the term may be assumed at two months, for which the insurance rate would be about 0.75 per cent. in a wooden elevator, and 0.15 per cent. if demanded in a fireproof one.

The owner's yearly investment and insurance expenses will then be:

For a wooden elevator—

Interest, 3½ per cent.; renewal fund, 2.9 per cent.; insurance, 2½ per cent.; total, 8.9 per cent. on $300,000; first cost per annum $26,700

For a fireproof elevator—

Interest, 3½ per cent.; renewal fund, 2.9 per cent.; (insurance, none); total, 6.4 per cent. on $400,000; first cost............ 25,600

Difference per annum to owner in favor of fireproof elevator...... $ 1,100

The grain shippers' insurance charges will be:

With a wooden elevator—

For summer, ten day insurance............0.25 per cent.
For winter, sixty day insurance............0.75 per cent.

With a fireproof elevator—

For summer, ten day insurance............0.05 per cent.
For winter, sixty day insurance............0.15 per cent.

The results of the estimates would, of course, be changed by change in the assumed data, but it is clear that a fireproof elevator could cost the commissioners no more per annum than would a wooden one, and that it would save to the shippers who store in it about four-fifths of their storage insurance. This conclusion is confirmed by the fact that almost all elevators built within the past two years are of fireproof material. I would therefore recommend that any elevator built by the commissioners for general use be made fireproof.

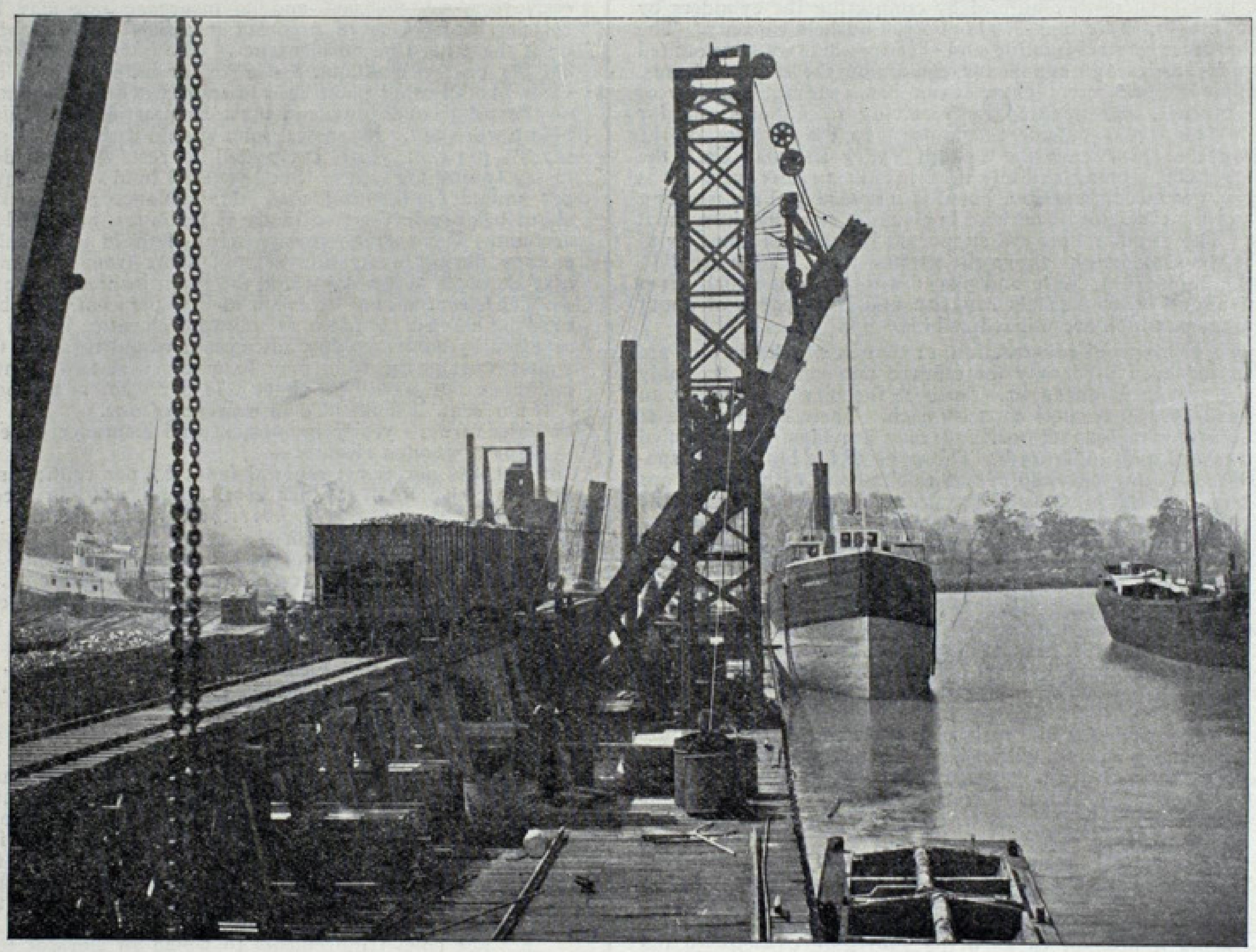
2. The chief requirements to which an elevator for the central part of the harbor should comply as regards its machinery and storage arrangements: It must, of course, be placed and equipped so as to take in grain from canal boats and cars, and to deliver to, say, four ships at any of ten berths, and also deliver to harbor lighters; and it should perform any or all operations separately or together. Grain shipments through Montreal are usually made up of small lots, whose identity must be preserved and the elevator bins should therefore be of small size, say about 12,000 bushels capacity each. These conditions would, on the whole, be best fulfilled by an elevator resembling the Great Northern of Duluth in its main features but greatly reduced in size and modified in structural details. The bins should be built of steel.

COMPASS PLATFORM TO BE INSULATED.

Rear Admiral Bradford, chief of the bureau of equipment, has received an interesting letter from Lieutenant-Commander F. M. Bostwick, navigator of the Oregon, in which he describes the effect on the standard compass of a "ground" in the bridge electric circuit. While the Oregon was steaming up the China coast on course N. E. by N., the navigator reports that it suddenly became necessary to change the course about a point to the eastward by bridge and steering compasses, to make the allotted course by standard. Upon investigation it was found that the trouble lay with the standard compass. A time azimuth taken showed the deviation of the standard compass to be 10° and 4-100 min. east, the tabulated deviation being 1° and 4-100 min. Upon inquiry it was found that the bridge circuit had just been turned on, and later a "ground" was discovered. Experiments showed conclusively that the fault was due to this "ground." In order that this trouble may be avoided in the future, the secretary of the navy has authorized the chief of the bureau of construction and repair to inform the commandants of the navy yards and the superintending naval constructors that hereafter the platforms for carrying the standard compass should, whenever practicable, be insulated from the structure of the ship by three-eighths of an inch of hard rubber fiber, and that the bolts securing platform stanchions to the structure should also be insulated by bushings and washers of the same material; also that all horizontal railings within 12 ft. of the compass should be made either of wood or Manila hemp rope.—Electrical World and Engineer.

SPECIAL CARRIER FOR LOADING COAL ON VESSELS.

C. O. Bartlett & Co. of Cleveland have lately installed at Fairport, Ohio, for the Pittsburg Coal Co. a special carrier for loading coal on vessels. The carrier handles with equal facility either hard or soft coal and has been the subject of considerable attention from coal shippers. The contrivance is of extremely simple construction and is operated as follows: The coal to be loaded on the boat is dumped from hopper bottom railroad cars into a large hopper underneath the car, and over the lower end of the carrier the coal is fed onto the carrier by means of large slides or openings opened and closed by power. The coal is then conveyed up this continuous carrier and delivered into a spout, which feeds the coal into the boat from the carrier. This spout is so arranged that it may be raised or lowered at will. The spout is worked by a special hoisting engine, and is raised or lowered as desired, taken up in a perpendicular position entirely out of the way of the boat as it passes along, and quickly lowered again. The spout is also made to telescope so that when the boat is being filled, the spout itself may be kept constantly full of coal, thus keeping the breakage at a minimum. The whole machinery is operated with less than 50 H.P., and loads up to 1,000 tons of coal per hour. When it is taken into consideration that the whole machinery is operated with less than 50 H.P. and with very little labor, it cannot fail to appeal to those who have a large amount of coal to handle.



Showing the carrier with the spout lifted up out of the way, so that the vessel to be loaded can be moved along either way.
Designed and built by C. O. Bartlett & Co., Cleveland.

SHIP BUILDING AT PHILADELPHIA AND VICINITY.

Philadelphia, Pa., Aug. 14.—The torpedo boat destroyer Bainbridge, building at Neafie & Levy's ship yard, will be launched Tuesday, Aug. 27. After a series of vexatious delays President Mathias M. Seddenger was able to definitely fix the date, and the program will be strictly adhered to. The honor of christening the destroyer will devolve upon Miss Louise Adele Bainbridge-Hoff, daughter of Capt. William Bainbridge-Hoff of Washington. Miss Bainbridge-Hoff is a sister of Lieut. Arthur Bainbridge-Hoff, United States navy, and a great granddaughter of Com. Bainbridge.

The launch of the Bainbridge and that of her sister ships, the Barry and Chauncey, all of which are side by side on the stocks, has been delayed by changes decided upon after Rear Admiral Bowles assumed the duty of chief constructor of the navy. One of the boats, built elsewhere on the same design, found difficulty in attaining the speed required by her contract and investigation led to the belief that changes in the stern lines to allow a freer escape of the water would increase the speed. The alteration has been effected by a slight cutting away of the stern aft of the propellers and arching it somewhat above the propeller blades. The speed demanded by the contract for these boats is 29 knots. Naval Constructor J. H. Hanscom, the government inspector here, believes that a full knot will be gained under the changed conditions and his opinion is shared by the builders. When the destroyers go overboard they will be practically ready for their trial trips. The Bainbridge is 95 per cent. completed, the Chauncey 90 per cent. and the Barry 88 per cent. Their boilers have been tested several times under steam, and in these trials have proved satisfactory.

It will be some months before the keel of the sheathed protected cruiser St. Louis is laid at this ship yard. Assistant Naval Constructor Robinson said that the keel plates for this vessel will go down on the blocks vacated by the cruiser Denver when the latter is launched. The Neafie & Levy Co. are unable as yet to assign a date for this event.

Constructor Hanscom and Mr. Robinson are very busy these days, dividing their time equally between Neafie & Levy's and Cramps' ship yard. They have begun the inspection of the first plates which have been delivered at the latter plant for the keel of the armored cruiser Pennsylvania, which is to go down alongside of her sister ship, the Colorado, and incidentally on the same spot where the Maine was built. In this connection it may be said that the builders have a little problem to solve in putting down the Pennsylvania. She is over 100 ft. longer than the Maine and will require many additional keel blocks. In the meantime the keel of the Colorado has been completed throughout its length and the latest naval estimate places the vessel at 3 per cent. completed. As she is an exact duplicate of the Pennsylvania, having them built next to each other is a very convenient arrangement, the same overhead traveling crane supplying both with material.

The Russian battleship Retvizan will sail from Cramps' ship yard on her builders' trial trip Saturday, Aug. 24. The latter will be run over the triangular course between Five Fathom Bank, Winter Quarter and North East End light-ships, outside the Delaware capes. The contract requirement is for a speed of 18 knots during 12 consecutive hours steaming. It is the intention of the builders to put the battleship through an equally stringent test with the one which she will undergo on her trial acceptance trial.

A rapid piece of work is being performed on the Clyde liner Comanche in Cramps' dry dock. This vessel reached the yard about three weeks ago to be lengthened 45 ft. and since that time the separation of the hull has been made and the intervening space is now in frame. It is expected that she will be in service within a month. The additional length will result in almost double cargo capacity. The work includes a thorough renovation of the interior of the steamship. In addition to the vessel construction which they have under way the New York Ship Building Co., at Kaighn's Point, Camden, N. J., is busily engaged in fitting the merchant steamship, formerly M. S. Dollar, now J. M. Guffey, as a tanker to run on the proposed oil carrying line between Sabine Pass, Texas, and Philadelphia. The M. S. Dollar is the pioneer vessel of the new ship building firm. It was originally contracted for by Robert S. Dollar of San Francisco, but was recently purchased by J. M. Guffey in the interests of the independent oil operators of Texas.

The new ferryboat Chancellor of the New York & College Point ferry line was successfully launched at the ship yard of the Townsend & Downey Ship Building & Repair Co., Shooter's island, N. Y., last week. The new boat is 175 ft. in length, 37 ft. breadth of beam, 60 ft. 6 in. over guards and 16 ft. depth of hold, and built of white wood throughout. She is equipped with single engines of the walking beam type.

PROGRESS OF WORK AT NEWPORT NEWS, VA.

Newport News, Va., Aug. 14.—This week witnessed the completion of the new pumping system for emptying the two large dry docks at the ship yard. The Newport News Ship Building & Dry Dock Co., it seems, takes the initiative in many things pertaining to ship building. It was the first private yard to undertake the building of a large Simpson dry dock, it was the first to introduce the electric cantilever traveling crane in ship construction; it was the first to use an electric revolving crane in ship building, and it has always taken the lead in the use of the most modern tools and methods employed in this kind of work. Now it has the most remarkable pumping system in America, probably in the world, being the only one applied to two mammoth dry docks. Their capacity is greater than the capacity of any other dry dock pumps known to ship building. For some years, in fact since the yard was first laid out, a 600-ft. basin has been doing all of the docking for the ship yard, but several years ago Collis P. Huntington realized that another and a larger dock was needed to properly handle the new and repair work of the company, and he gave orders for the construction of a basin nearly 900 ft. in length, which is in use today and which is capable of receiving at one time two of the largest warships afloat. The largest merchant ship ever built can be docked in the new basin with room to spare, and it will be some time before a vessel will be floated which cannot find a berth in it.

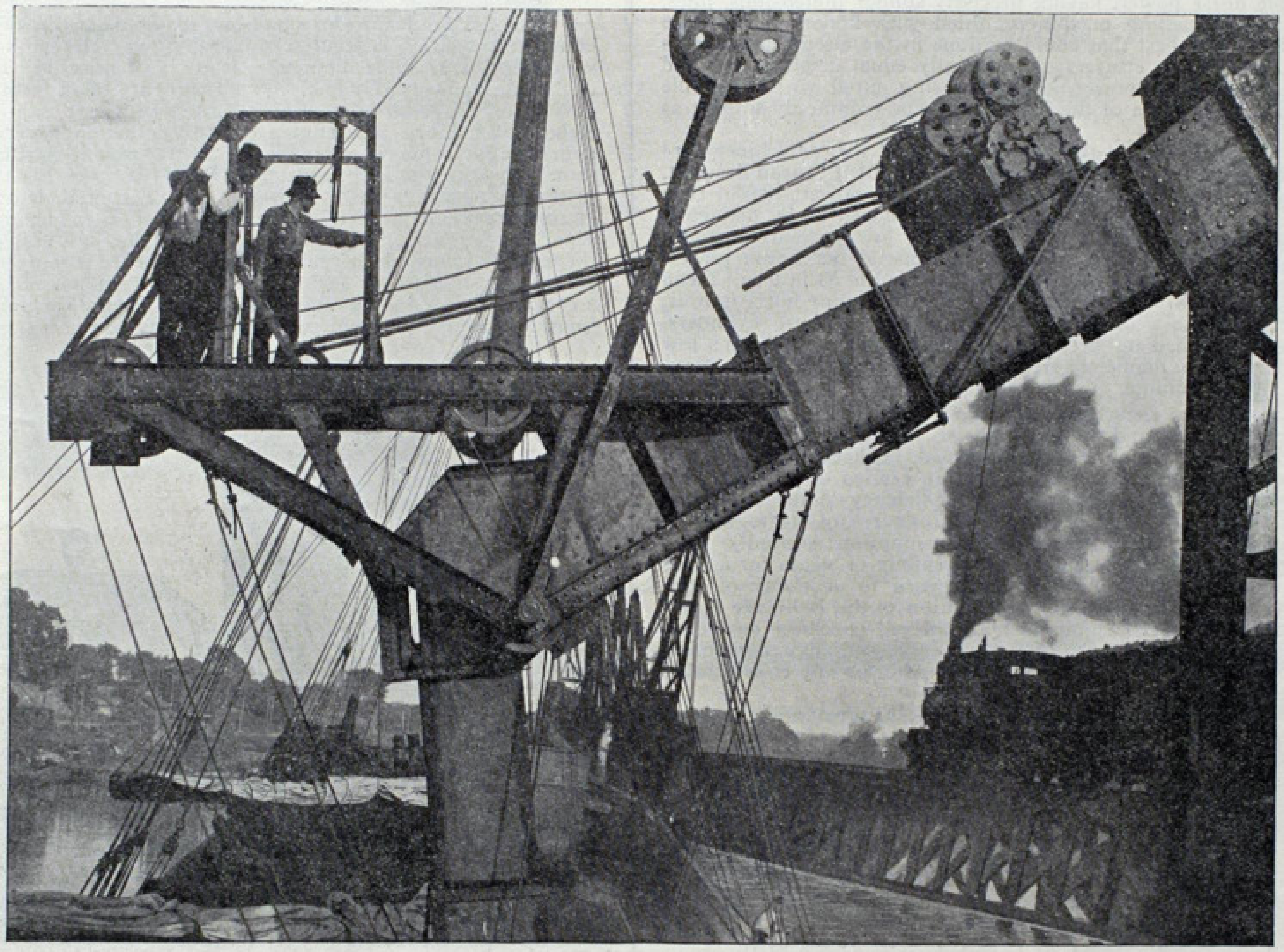
The pump which emptied the 600-ft. dock in about an hour and a half is located to the south of the basin. With the completion of the new pumping system this house will be closed and kept for emergency. The new pump house is situated between the great new dry dock and the old basin, about 53 ft. from the former and 103 ft. from the latter. A 9-ft. circular tunnel connects it with the new dock and a 7-ft. circular tunnel connects it with the old one. Should the occasion arise, both docks could be emptied simultaneously. The combined highest capacity of the pumps is 410,000 gallons a minute, or 24,600,000 gallons an hour. There are two large pumps with a capacity of 200,000 gallons a minute each, and one small pump with a capacity of 10,000 gallons a minute. The small pump makes about 200 revolutions a minute, throwing out about a barrel with every revolution. It is operated nearly to its full capacity.

The large pumps are not run to their full capacity, but ordinarily they throw out about 125,000 gallons of water a minute. They have suction pipes 5 ft. in diameter, while the small pump has a 22-in. suction pipe. The large pumps are used to empty the basins until the water gets toward the bottom, when the smaller pump is put to work draining it off. With the pumps working at average capacity, the large dry dock can be emptied in about two hours; the 600-ft. dock in a little more than an hour. This is remarkably quick time and it cannot be approached by any other dry dock in the country, three and four hours being required to empty some docks not nearly so large as those here.

The old pump house, operating only one dock, required two engineers and several firemen. The new pump house, operating two docks and doing more than double the work, requires but two men, one engineer and one electrician. The new pumps are operated entirely by electricity, the machinery consisting of two 800 H.P. motors, for which power is furnished by three 800 H.P. dynamos. As the water is pumped from the dry docks it passes to a brick culvert 50 ft. long, 15 ft. wide and 5 ft. high. There are two butterfly valves operated by electricity from the pump house. The new dry dock has been in operation some weeks and it is handled with remarkable ease and dispatch. At one time there have been in it as many as three steamers at one time, and ever since its opening it has been kept constantly at work, so great has been the amount of repair work secured by the yard. For several weeks the old dry dock has been occupied by the North German Lloyd liner Main, which is being rebuilt at a cost of nearly $1,000,000. The old dock was operated for the first time under the new pumping system this week, with the floating of the Main, which will be ready to leave the ship yard about Oct. 1, practically a brand new vessel and with no sign of the damage it suffered in the Hoboken pier conflagration.

The next launching at the ship yard will occur Sept. 28 or Oct. 5, when the Pacific Mail leviathan Siberia will go overboard. It is probable that the Morgan liner El Alba will be launched at the same time. Preparations for the Siberia launching have commenced. The Old Dominion steamer Hampton, which was damaged in collision with the steamer Jamestown, resumed her runs between Old Point and Norfolk early in the week after being repaired here. The British steamship Wragby, which collided July 25 near Bermuda with the British ship Foyle, is now at the ship yard for repairs. The Wragby was struck by the Foyle opposite the forward hatch. Her plates were stove in from the water line up, the decks started and other damage done to rail and top gear. The Clyde line steamer Yemassee is at the yard for repairs. The Yemassee, the schooner Josie L. Burt and the large barge Ohio were all put in the dry dock together. The Pacific Mail liner Korea and the steamer Simon J. Murphy have been taken out of the dock. A number of other vessels, mostly barges, are undergoing repairs. The ship yard has recommended to the navy department some changes in the plans for the protected cruiser Charleston, which, it has reason to believe, will operate to the advantage of this class of ships.

The trim little passenger steamer Norfolk-on-the-Roads, which ran day and night between Old Point Comfort and Sewall's Point for the Norfolk & Atlantic Terminal Co., was burned to the water's edge last Thursday at her dock at the latter place. The Norfolk-on-the-Roads was formerly the Salacia and was built at Bath, Me., for the Maine & Coastwise Steamship Co. For several years she had been plying between Cuba and northern ports. She was purchased in 1900 by the Norfolk & Atlantic Terminal Co., taken to Baltimore, where she was refitted and greatly improved and then brought to these waters. She was 120.9 ft. in length, 26.2 ft. in breadth, 10 ft. in draught and had a gross tonnage of 332.4 and net of 168.4. The company will replace her with a new steamer if it is found that the hull is beyond rebuilding.



Showing the spout lowered into the hold of the vessel. It also shows the engine on top of the spout, used in raising and lowering the spout at will.
Designed and built by C. O. Bartlett & Co., Cleveland.

The yacht Independence, owned by Thos. W. Lawson of Boston and built to defend the America's cup, has twice this summer been docked at the yard of the Thames Ship Building Co., New London, Conn.

A new chart, in colors, of Erie harbor and Presque Isle, has just been issued and may be had from the Marine Review. A new chart of Buffalo harbor and Niagara river to the falls is also in print.

Percy & Small, Bath, Me., will launch the four-masted schooner Cordelia E. Hayes in a few days.

EXPERT'S COMMENT IN HYACINTH AND MINERVA TRIALS.

Reviewing the interesting series of trials of the Hyacinth with Belleville boilers and the Minerva with cylindrical boilers, an expert in the London Times says:

The trials have been made by request and under the supervision of the boiler committee appointed for the purpose of investigating the very important question concerning the wisdom of fitting water tube boilers on board our war vessels, and in this capacity their investigations are necessarily directed more particularly toward the Belleville boiler, owing to its having been adopted in our navy, for large war vessels, practically to the exclusion of other types. It should be borne in mind that several members of the house of commons have declared, in the most emphatic manner, their opinion that water tube boilers generally, for marine purposes, were both dangerous and excessively wasteful of fuel. It was in consequence of these declarations that the committee was appointed to investigate the truth of such statements and thereby alleviate the anxiety in the public mind. It was desirable to make comparative trials between the cylindrical and Belleville boilers, working, as far as possible, under precisely similar sea-going conditions. It was difficult to make such comparisons, owing to the fact that our navy does not possess two vessels of any considerable horse power, having precisely similar dimensions, lines, displacement, and propelling machinery, fitted with boilers of the two types in question. The best that could be done in the circumstances was to select two second-class cruisers of practically equal displacement and maximum indicated horse power, the one being fitted with Belleville boilers, the other with those of the cylindrical type commonly known as Scotch boilers.

The general dimensions of the two ships and of their machinery are as follows: The Hyacinth—Length, 350 ft.; breadth, 54 ft.; mean draught, 20 ft. 6 in.; displacement, 5,600 tons; maximum horse power, 10,000; twin screw engines of four cylinders; high pressure cylinders, 26 in. diameter; intermediate pressure cylinders, 42 in. diameter; low pressure cylindes (2), 48 in. diameter; stroke, 2 ft. 6 in.; revolutions at maximum power, 180 per minute. The Minerva—Length, 350 ft.; breadth, 53 ft. 6 in.; mean draught, 20 ft. 2 in.; displacement, 5,600 tons; maximum horse power, 9,600; twin screw engines of three cylinders; high pressure cylinders, 33 in. diameter; intermediate pressure cylinders, 49 in. diameter; low pressure cylinders, 74 in. diameter; stroke, 3 ft. 3 in.; revolutions at maximum power, 140 per minute.

It will be noted that the vessels and their propelling machinery are not precisely comparable; and consequently so far as speed of ship per I.H.P. or efficiency of the engines are concerned, no heed need be taken of the results of the trials. The trials have been carried out for the purpose of comparing, as far as practicable, the efficiency of the two types of boiler from two points of view—first, as producers of steam from a given weight of coal, in other words, coal consumption; secondly, their capacity for producing an ample and constant supply of steam for a long run at maximum speed, having no special regard to economy of fuel. Those who have so bitterly criticized the adoption of the Belleville boiler in our navy have laid special emphasis upon alleged excessive coal consumption, and in the second place they have expressed their conviction that it would be impossible to maintain a high speed for any considerable period with these boilers.

The trials having now been completed; a brief summary of the principal results will be interesting to show whether the confident assertions that the strength of our navy has been jeopardized by the introduction of these boilers have, or have not, any foundation.

First coal consumption trial, 24 hours' duration, 2,000 H.P.:

	Mean. I.H.P.	Actual evaporation of water per lb. of coal.
The Hyacinth	2,053	9.69
The Minerva	2,142	8.54

Result—13.4 per cent. in favor of Hyacinth's boilers.

Second coal consumption trial, 24 hours' duration, 5,000 H.P.

	Mean. I.H.P.	Actual evaporation of water per lb. of coal.
The Hyacinth	4,992	9.41
The Minerva	5,155	8.87

Result—6 per cent. in favor of Hyacinth's boilers.

Third coal consumption trial, 12 hours' duration for Hyacinth, and eight hours for Minerva, 8,000 H.P.:

	Mean. I.H.P.	Actual evaporation of water per lb. of coal.
The Hyacinth (12 hours)	8,105	9.89
The Minerva (8 hours)	8,114	8.19

Result—20.7 per cent. in favor of Hyacinth's boilers.

Fourth coal consumption trial, eight hours' duration:

The Hyacinth was tried for eight hours at a maximum power of 10,000 H.P., but no trial was made of the Minerva at full power, as it was considered undesirable to force the cylindrical boilers to their original specified maximum power of 9,600. The mean I.H.P. for eight hours in the Hyacinth was 10,181 and the actual evaporation of water per pound of coal during that period was 8.8, showing that at the maximum power of over 10,000 the Hyacinth boilers were doing better duty per pound of coal than the Minerva cylindrical boilers did at 8,000 H.P., the latter having evaporated only 8.19 of water per pound of coal at the lower power.

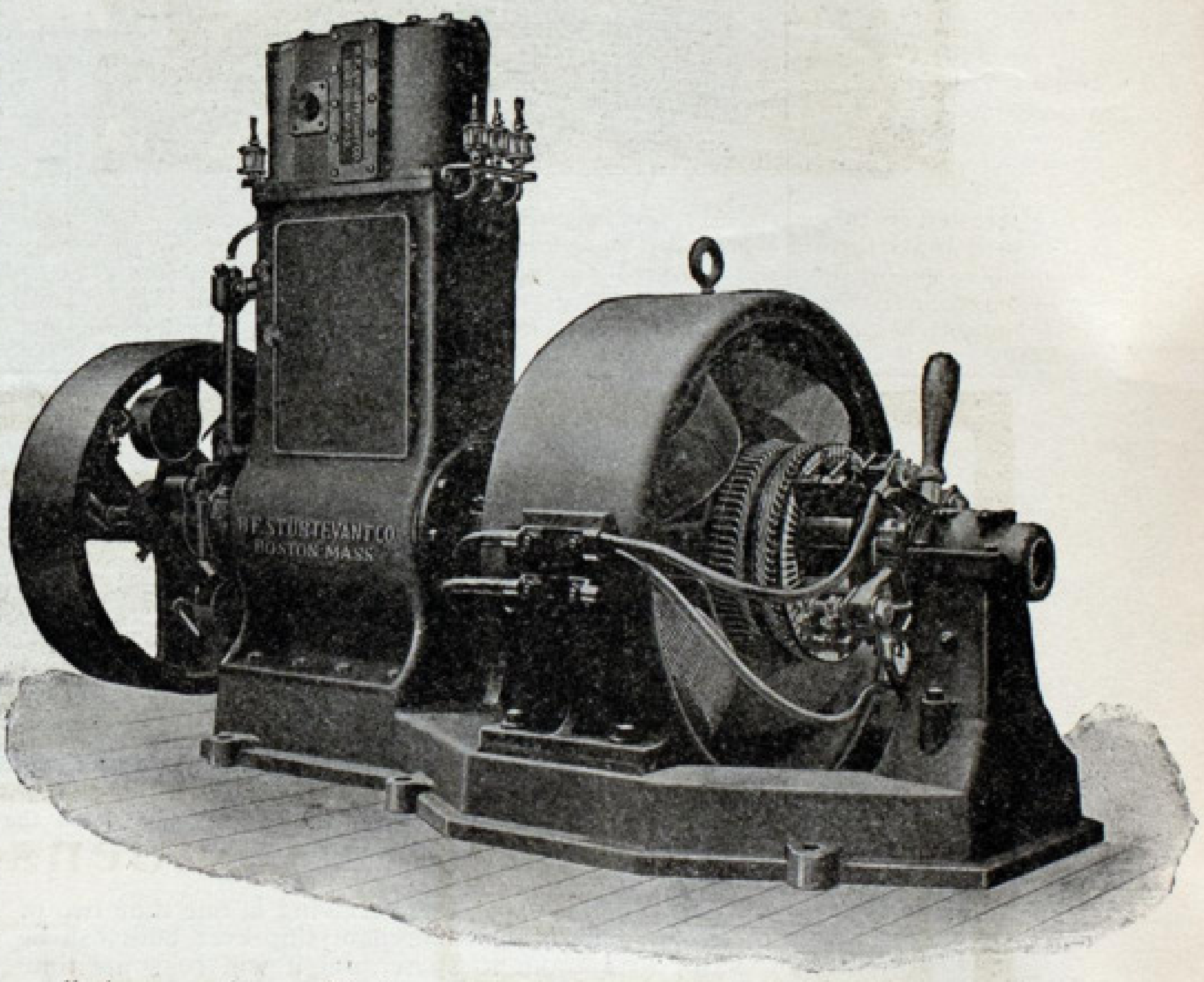
After these trials certain modifications were made in the boilers of the Minerva, and upon trial, with half the boilers, burning coal at the rate equivalent to that consumed upon the 8,000 I.H.P. trial, the evaporation per pound of coal was found to be about 9 per cent. better, consequently, in comparing the results of the third coal consumption trial, it would perhaps be fair to place 9 per cent. to the credit of the Minerva.

The vessels were now prepared for the last of this series of trials, which consisted of a run from Plymouth to Gibraltar, each vessel to maintain, as nearly as possible, 7,000 H.P., and after touching at Gibraltar to proceed until the coal on board was exhausted. The return run from Gibraltar to Portsmouth was to be at maximum possible speed, without any regard to coal consumption. Both vessels started at the appointed time and touched at Gibraltar, signalling all well, and proceeded to exhaust their coal supplies. After steaming 103½ hours at 7,000 H.P. the Hyacinth was obliged to put in to Gibraltar, owing to having lost a considerable quantity of water through leaky feeding connections. The Minerva returned, after steaming about 150 hours, having stopped for some two or three hours owing to derangement of the machinery. Taking into consideration the time under way and the H.P. developed, the coal consumption per pound of water evaporated appears to be slightly in favor of the Hyacinth, but for practical purposes the results may be taken as equal. It is only fair to note, however, that the loss of water, through defective feed connections, must have told considerably against the efficiency of the Hyacinth boilers.

Regarding the home trip the expert says that from a scientific standpoint the most instructive part of the race was when the Minerva steaming at 8,400 I.H.P. drew away from the Hyacinth steaming at 9,400 I.H.P. It showed that the Minerva possessed an advantage, either in the form of her propellers or in the superiority of her lines, for when the Hyacinth made a sprint of three hours at 10,000 I.H.P. she merely churned the water without appreciably increasing her speed.

COMPACTNESS IN GENERATING SETS.

A distinctive feature of small and medium sized generating sets is the compactness which is secured in late designs. Herewith is illustrated one which possesses some distinctive features of novelty. The running gear of the engine is entirely enclosed, all parts are oiled from sight feed oiling devices on the exterior, and access to the interior is provided through a tight fitting door. The engine is of the compound vertical type and its general appearance is very similar to the double vertical engine of the same company, the B. F. Sturtevant Co. of Boston, Mass., by whom a line of these generating sets is now being built from their own designs. The engines range from a 4-7x4 up to a 8½-15x7. The cylinders are in a separate casting from the frame, to which they are bolted, thus rendering them easily removed for repair. Two valves are employed, one controlling admission of steam to each cylinder, and motion is transmitted through a rocker, provided at its outer end with an accurately fitted ball-and-socket joint, and at its inner end connected by link to the valve stem yoke. The



cylinders are thoroughly lagged to prevent condensation, and danger of damage from water in the cylinders is avoided by the use of special automatic relief valves.

The generator is of the standard four-pole Sturtevant type, with magnet frame of special magnet steel, with field cores cast on. To these the pole shoes are secured by cap screws. The armature is of the barrel wound toothed drum type. Ventilation is effected by the use of specially constructed air ducts between the laminae of the core. These convert the armature into a blower and create a strong draft through the windings. The winding for low voltage machines is of copper bars with easy bends. High voltage machines are wire wound with machine formed coils. The commutator consists of drop forged segments of pure copper, secured between cast iron flanges of spider construction, which allow free circulation of air.

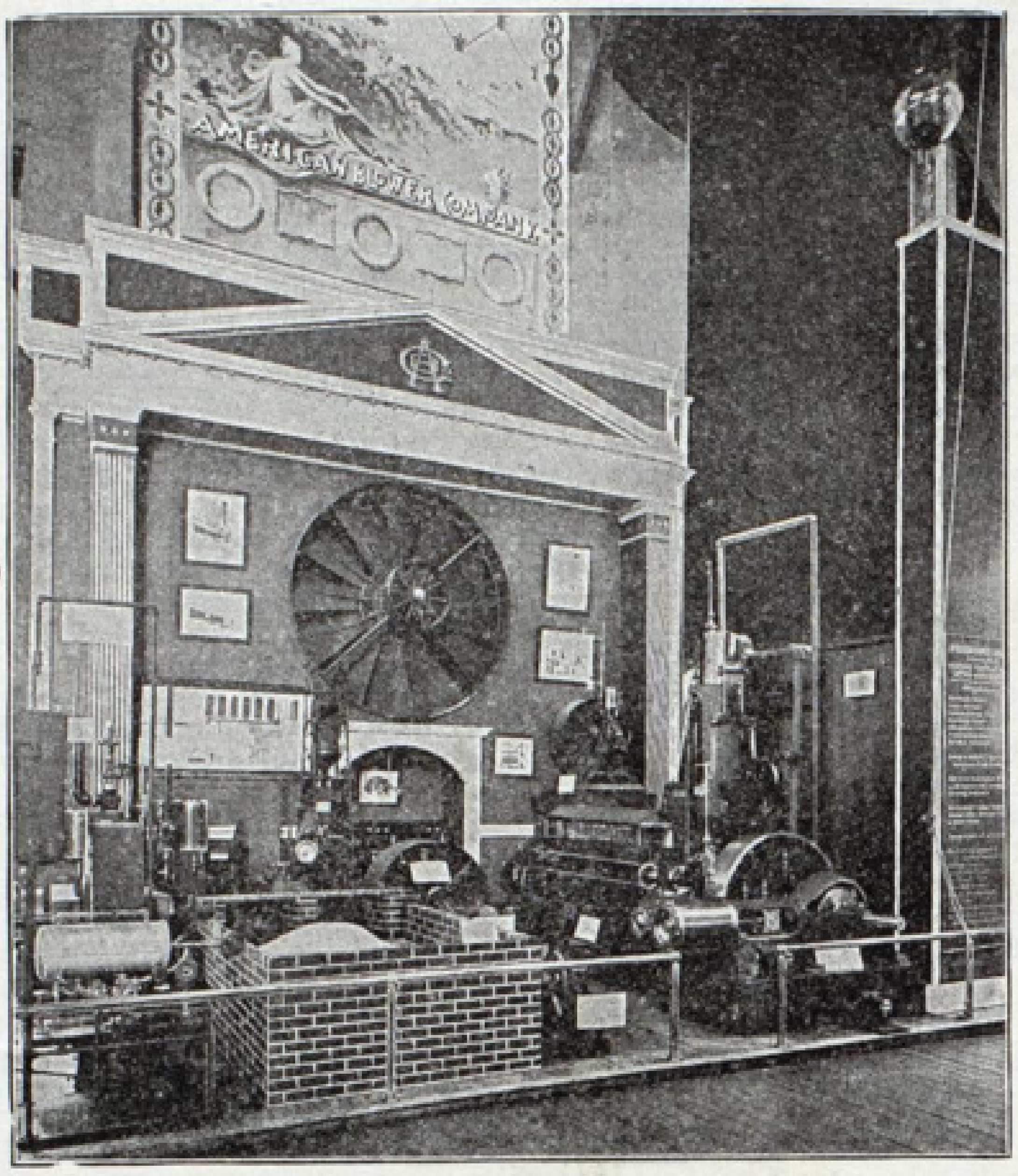
All machines are fitted with carbon brushes mounted in holders of the sliding socket type. The field coils are double cotton covered and are rendered absolutely oil and water proof by saturation in a special compound and subsequent baking at high temperature. The armature is subjected to a similar treatment.

All machines are given a full load test for a sufficient time to bring every part to its maximum temperature, which never exceeds 40° Cent.

Mr. P. H. Cheney of the firm of P. H. Cheney & Sons, ship chandlers at Ashtabula, died at his home on Sunday afternoon. He was one of the best known marine men on the lakes and had had a long and useful career. For eighteen years he was light-house keeper at Ashtabula and for nearly twenty years past had been engaged in the ship chandlery trade at that port. He had a personal acquaintance with practically every captain on the lakes and was universally esteemed. His death was due to a number of complications from which he had suffered for a year past. He was 65 years old.

AMERICAN BLOWER CO. AT PAN-AMERICAN.

In block No. 26 of machinery hall, at the Pan-American exposition, is an exhibit of heaters, fans, engines, blowers, dry kilns, trucks and other kindred machinery, which is quite interesting and well worth the few minutes time necessary to inspect it by anyone who has use for such machinery. Almost every one is in-



terested in this particular line, as these devices enter into almost all lines of manufacture in some way or other. The booth this company has put up is one of the handsomest in the building. The general scheme is rendered in ivory white and deep green. This feature is some 20 ft. in height, being topped by a gable end resting on some very prominent columns. Above same is a large painting nearly 60 ft. in height, designed to be somewhat emblematical of the American blower.

The company has another feature which attracts a great deal of attention, being a model of their widely known and very successful "moist air" dry kiln. This model has a glass side, enabling the spectator to see the exact operation of the kiln. They also have a large 140 in. full-housed steel plate fan running, being driven by an 8x8 marine type vertical engine, coupled direct to the fan shaft. From the discharge of this fan, which points upward, they have myriads of yellow and blue ribbons streaming up into the air. These colors, of course, are the college colors of the University of Michigan, and no Michigan college graduate goes by without noticing it, and it likewise always attracts a great deal of attention from the ladies. In the wall back of the exhibit they have fitted a 108 in. disc fan, which is about as large as one commonly sees in such a place. It is by no means the largest they build, however. They are also exhibiting a Moorehead automatic return steam trap in operation, which clearly shows how the trap drains condensation from heating surfaces and delivers it direct to the boiler. There is also a large pressure blower mounted on a Z iron base, on the other end of which is the vertical automatic high-speed engine for driving same. They are also showing a horizontal, automatic high-speed engine and a vertical low pressure engine, as well as their widely known A, B, C exhaust fans, the adjustable features of which have been so frequently enlarged upon that further mention is hardly necessary here.

The Greenfield Steam Engine Works, 5th and Cross streets, East Newark, N. J., reports phenomenal success with their engine output since the establishment of the company in 1874. Besides the manufacture of the "Greenfield" vertical, stationary, throttling and automatic and yacht engines, they manufacture horizontal and vertical, stationary and marine boilers; also many steam appliances and stationary and marine gas and gasoline engines. This company has furnished since the middle of June to the United States government eleven engines for new cruisers and have altogether on different cruisers 184, and in other branches of the government bureau of engraving and printing, hospital service, etc., from twenty-five to thirty more. The Standard Oil Co. is a large purchaser, having taken in all about 250 engines. In the gas works of the United States there are installed from 575 to 600, and the same number sold to other companies and individuals throughout the country. The engines, which are built for all purposes, range from 3 to 300 H.P. The motto of the company has come to be "Once a customer, always a customer." It would certainly pay intending purchasers to write for circulars and full information before ordering elsewhere.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, have just issued a card of sizes of staybolts for use in locomotive, marine and stationary boilers. The card is accompanied with a little circular setting forth the advantages of the staybolts and both will be sent to anyone upon application.

ON SCREW PROPELLERS.*

Propellers have usually been designed up to the present time by means of practical rules deduced from trials and comparisons, or from empirical formulæ having no connection among themselves, depending chiefly on workshop tradition, and personal prejudices of the designer, varying in different countries, and showing generally very little knowledge of the working of screws in water. Imperfect as this method is, so long as screws of large diameter and slow rate of revolution were dealt with, giving moderate speeds, the approximate formulæ sufficed, and often gave remarkably efficient propellers, although sometimes resulting in surprises and failures. But now that higher speeds are sought, by increasing the rate of revolution of the engine, the screw conditions become more difficult, the old rules are no longer suitable, and others more scientific are required, based on the laws of fluid resistance, which will make it possible to calculate exactly all the elements to suit varying conditions of power, speed, and revolutions.

Some years ago the author presented to the Association Technique Maratime a paper on the general theory of propellers, based on the resistance of a submerged plane. Encouraged by its favorable reception, he endeavored to obtain further proof of its correctness, by comparing the results of the trials of a large number of screws with the results predicted by his theory, and found them in close agreement. He has found it possible to explain hitherto obscure peculiarities in their action, and to discover the rationale of the empirical rules in use. To recapitulate briefly the principles upon which the theory is based, the author has shown that an element of a narrow inclined plane moving through a fluid experiences a resistance which can be resolved into two components, one of which represents useless resistance, and the other useful thrust, which is perpendicular to the first. These two component forces are related to each other in a manner independent of the speed, and depending only on the angle made by the plane to the direction of motion. He has shown that the useful component is a maximum when the plane is inclined at an angle of a little less than 3°.

In order to get the best effect from the blade of a propeller, each element of it should have this angle of incidence. The surface fulfilling this condition is a helicoidal one of variable pitch. The author proceeds to show how to draw the variable pitch to produce the required result, and he calls a "normal screw" one in which this angle of incidence has been secured for every part of the blade, and in which the diameter of the boss bears a certain fixed ratio to the diameter of the screw. A screw of uniform pitch can be altered so as to give the desired constant angle of incidence, by twisting the blades in the boss to a greater pitch. The chosen angle of incidence, which is 2° 52″, corresponds to a mean pitch equal to 1.25 times the diameter. He proposes to use certain definite shapes of blade, the curved outlines of which can be mathematically expressed. Propellers designed according to this theory will have all their dimensions, such as diameter, pitch, surface, diameter of boss, etc., expressible as a function of one of them. He proposes to state them in terms of the advance of the screw per revolution, and he thinks that great benefits would result if all propellers were designed upon some uniform theory, such as he sets forth.

All screw propellers which give satisfactory results may be said to approach more or less perfectly to a common ideal type, of which the elements are strictly determinable by the general laws of mechanics and fluid resistance, and these are mutually related in a manner explained by the author in a paper communicated to the International Congress of Naval Architects in Paris in 1900. The name of "normal screw" has been given to a perfect type of screw determined by exact calculation. It has been shown that all the geometric dimensions are proportional to one of the elements, the advance per revolution. It follows that, if all the elements of the "normal blade" be expressed in terms of the advance per revolution, a series of abstract numbers will be obtained, which will be the same for all "normal blades" without exception. Whatever may be the type of boat to which they belong, or the speed, number of revolutions, etc., the screws will differ only in size and in number of blades. These abstract numbers can be grouped in a single table in such a manner that it will only be necessary to take as unity any given advance per revolution, when it will be possible to determine at once all the dimensions of the "normal blade" suitable for this rate of advance. The author recommends that experiments should be made with a large number of "normal screws" varying slightly from each other, in order to ascertain with certainty the proportions suitable for obtaining the best results.

A table is given showing the proportionss of the "normal blade." As this is designed to have a constant angle of incidence equal to 2° 52″, it follows that the pitch is different at different radii, being less in the center of the blade than at the root and at the extremity. The number of blades to be employed is a function of the midship section, the advance per revolution and the hull efficiency.

The proposed method of designing screws will much simplify the drawing process, since one screw will differ from another only in scale. In small vessels where twin screws cannot be used, the engine requires to run faster than would be possible with one normal screw, the author recommends multiple screws placed one behind the other on the shaft.

*Extract of a paper read before the Institution of Naval Architects by M. Drzewiecki.

A British admiralty chart, Midland section of Georgian bay, will be sent, postpaid, to any address for $1.25; regular price $1.75. Size of sheet 3x4 ft. The Marine Review Pub. Co., Perry-Payne building, Cleveland. Chart of the whole bay on one sheet at the same price.

"The Construction of a Gasoline Motor Vehicle" is the title of an interesting and useful book which has just been issued by Emil Grossman & Bro. of New York. It is the story of a gasoline motor vehicle from the time of conception up to the hour of completion and is illustrated with working drawings.

WITH THE COAST SHIP BUILDERS

Following is a description of the new steamer which the Pusey & Jones Co., Wilmington, Del., are building for the Bordentown & Philadelphia Transportation Co., for service between Philadelphia and Bordentown, N. J. Dimensions: length on deck, 135 ft.; length between perpendiculars, 127 ft.; beam molded, 24 ft.; beam over guards, 28 ft.; depth, 9 ft. The speed will be 15 statute miles per hour in still water. The draught of water will be 6 ft. aft, 3 ft. forward, without cargo; with tank forward of sufficient size to trim the boat for a mean draught of 4½ ft. There will be three water tight bulkheads, one forward and one aft and one forward of boiler, constructed of 9 lb. plates and stiffened by steel angle bars 2½ in. x 2½ in. x 5 lbs. All compartments are to be fitted with sounding tubes. There will also be two bulkheads of 5 lb. plates, one between engine and boiler and one aft of engine, stiffened with 2 in. x 2 in. x ¼ in. angles, and fitted with doors. The forward compartment of collision bulkhead is to be used for trimming vessel, and to be filled and emptied by pump in engine room. The new steamer will be fitted with one fore and aft compound engine, connected to crank shaft at right angles, and fitted with a Schutte condenser. The cylinders of the engine will be 14 in. and 26 in. in diameter by 22 in. stroke, both cylinders having slide valves operated by link motion and fitted with steam reversing gear. The propeller wheel will be 7 ft. in diameter, with four blades. The boiler will be of the Scotch type, 11 ft. diameter by 10 ft. 6 in. long, of steel, built for working pressure of 125 lbs. per sq. in. It will have two corrugated furnaces, each 44 in. in diameter.

It was announced in the Review last week that the Gulf Coast Ship Building & Dry Dock Co. had selected Alabamaport as the site for its ship yard. The company is chartered under the laws of Alabama and is organized with a capital, including stocks and bonds, of $4,000,000. It is understood that the plant will be capable of turning out any class of ship from a torpedo boat to a battleship. One of the gentlemen interested in organizing the company said: "The place selected is the best adapted for the purposes of a ship yard of any port south of Newport News, having a natural harbor with a 20 ft. channel, which we intend to dredge out to 32 ft. We will also build a basin and docks for use in connection with the Mobile & Ohio, and possibly the Louisville & Nashville, in receiving and discharging cargoes. The port of Alabama is also desirable as a location for a ship building and marine railway plant because it is in proximity to the coal, iron and lumber industries of the state. All material necessary can be procured at less cost than in the north and labor is relatively cheap. The company is assured of a large business from the outset. We will take over the Johnson ship building and machine shops at New Orleans, with their dry dock of 2,000 tons capacity. This plant will be enlarged and a floating dry dock built capable of taking in a 10,000 ton ship."

Lane & DeGroot, Brooklyn, N. Y., have signed a contract with southern parties for a cabin launch, length 50 ft., beam 13 ft., depth 6 ft. 6 in., to be finished in mahogany. The International Gas Engine Co. of No. 26 Broadway, are to furnish a 25 H.P. motor for this launch, to be completed in sixty days.

The Nantasket Steamboat Co. has given a contract for a new passenger steamer to Montgomery & Howard, Chelsea, Mass. The new steamer is to be 198 ft. over all, 190 ft. keel, 34 ft. beam and 11 ft. 5 in. deep. Engines will be furnished by the W. & A. Fletcher Co., Hoboken, N. J.

Capt. John G. Crowley, Taunton, Mass., will have another seven-masted schooner built, somewhat similar to the one under contract at the Fore River Ship & Engine Building Co.'s yards at Quincy, Mass., to be 365 ft. long, 50 ft. beam and 34 ft. deep, with a cargo capacity of 7,000 tons.

It is reported that Messrs. T. Hogan & Sons, New York, have contracted with Messrs. J. L. Thompson & Sons, Sunderland, for the construction of two large steamers, and with Messrs. C. S. Swan & Hunter, Newcastle, for the construction of one large steamer.

The Parkersburg Dock Co., Parkersburg, W. Va., is building a towboat of the following dimensions for Capt. John S. Summers: 100 ft. long, 22 ft. beam and 4 ft. deep. The vessel will be equipped with engines having 700 H.P. and will cost about $20,000.

As soon as the big schooner William P. Frye is out of the way Arthur Sewall & Co., Bath, Me., will begin work on a five-masted steel schooner of about 3,000 tons capacity.

Bids will soon be invited for the erection of four buildings, a power house, foundry, machine shop and an office building, for the new naval plant at Algiers, La.

Washburn Bros., Thomaston, Me., have stretched the keel for a new five-masted schooner, the length of which is to be 225 ft.

A number of very complete outfits of driving machinery and boat equipment, accompanied by plans and specifications for building the hull and installing the machinery, have been sent out by the Marine Iron Works, station A, Chicago. Several similar contracts now under way. This is a plan that they have demonstrated to be an exceptionally good one, particularly for those located at a distance where they may have suitable material and good men to do the work, provided they secured the necessary information with plans and details, all of which the Marine Iron Works furnish with their complete machinery outfits when so contracted for. 3

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Detroit Shipbuilding Co.........................Detroit.
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Niles Tool Works Co.........................Hamilton, O.

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Garlock Packing Co.......................Palmyra, N. Y.
Jenkins Bros...................................New York.
Katzenstein, L. & Co...........................New York.
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U. S. Metallic Packing Co..................Philadelphia.

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Merrell Mnfg. Co...............................Toledo, O.

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Bourne-Fuller Co...............................Cleveland.
Crane Co.......................................Chicago.

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Niles Tool Works Co.........................Hamilton, O.

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Atlantic Works, Inc........................Philadelphia.

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Bement, Miles & Co.........................Philadelphia.
Cleveland Punch & Shear Works Co...............Cleveland.
Niles Tool Works Co.........................Hamilton, O.
Wood & Co., R. D...........................Philadelphia.

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Standard Pneumatic Tool Co.....................Chicago.

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Bertram's Oil Polish Co.........................Boston.
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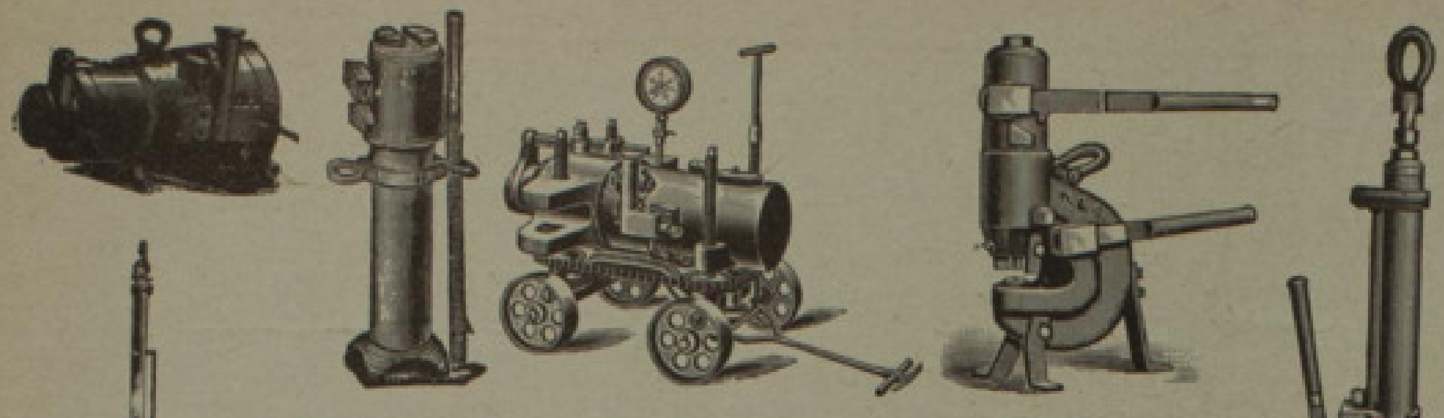

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No. 32, Fast Mail	*11 25 am	*11 30 am
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No. 46, Southwestern Express	....	*3 00 pm
No. 6, Limited Fast Mail	*5 40 pm	*5 45 pm
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No. 16, New England Express	*10 30 pm	*10 35 pm
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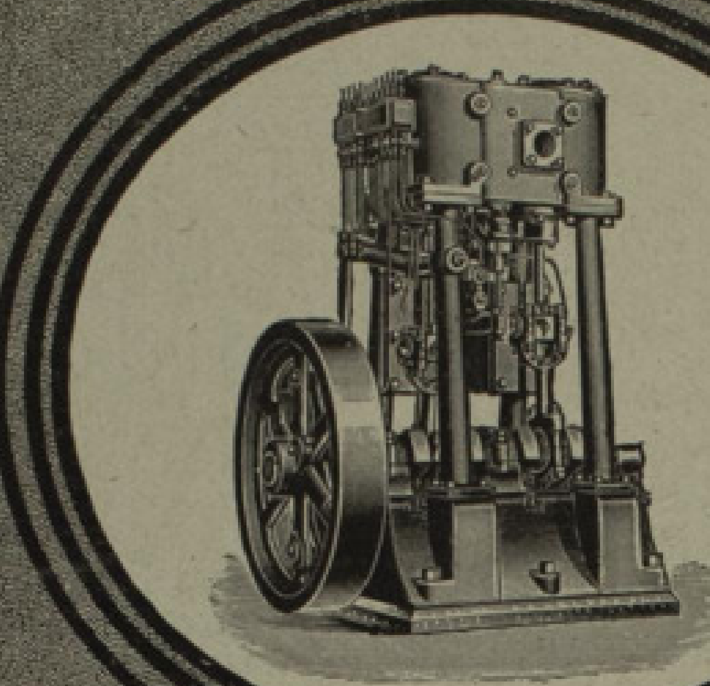

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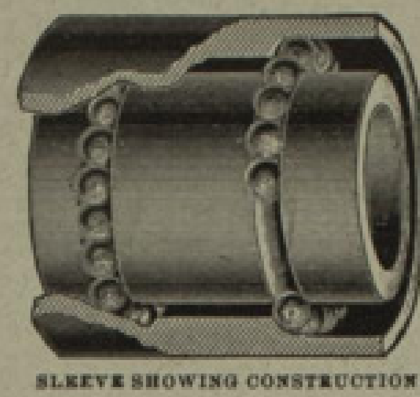

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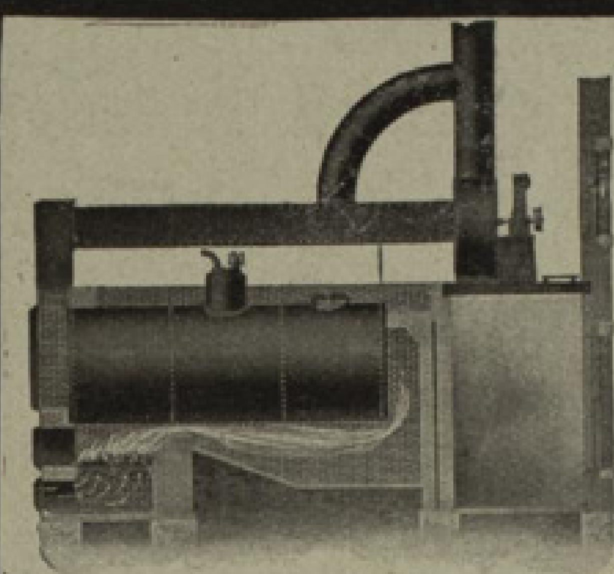

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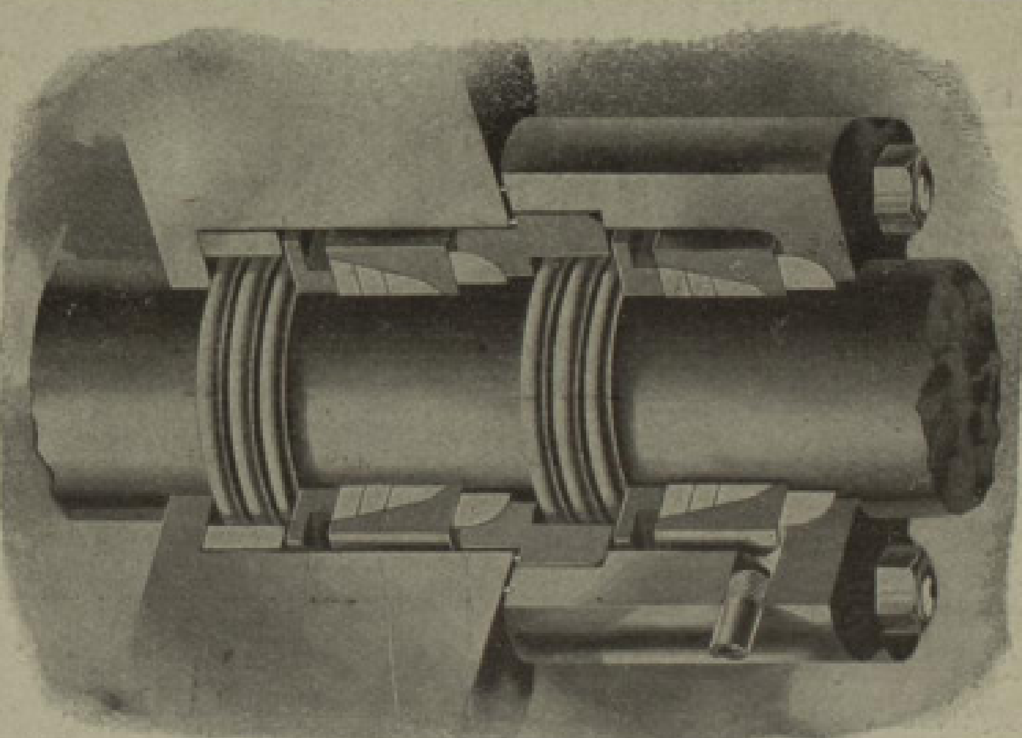

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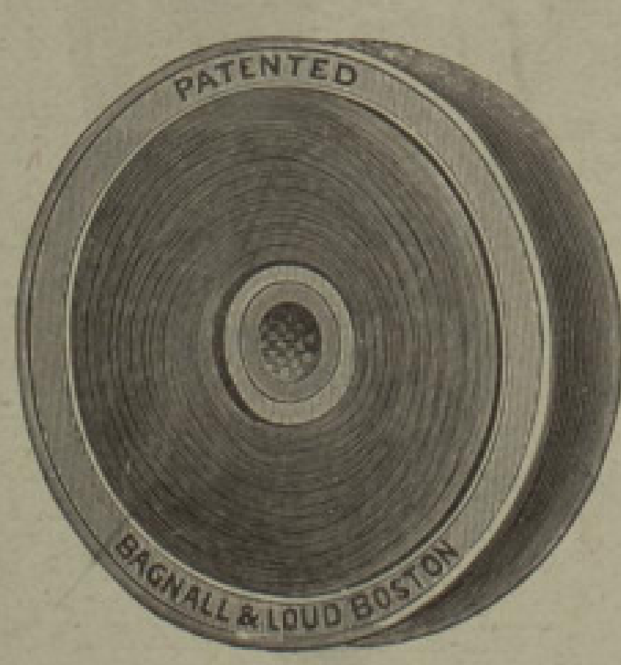

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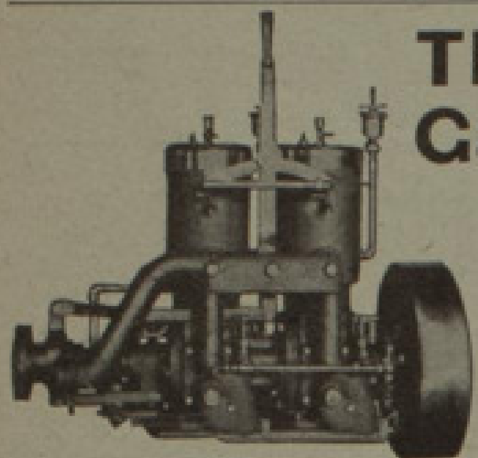

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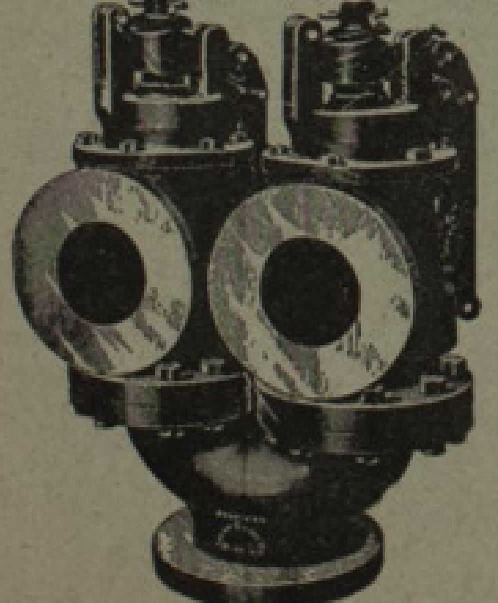

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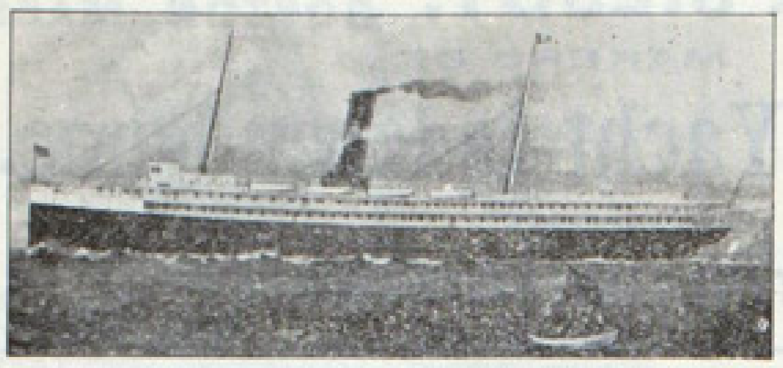

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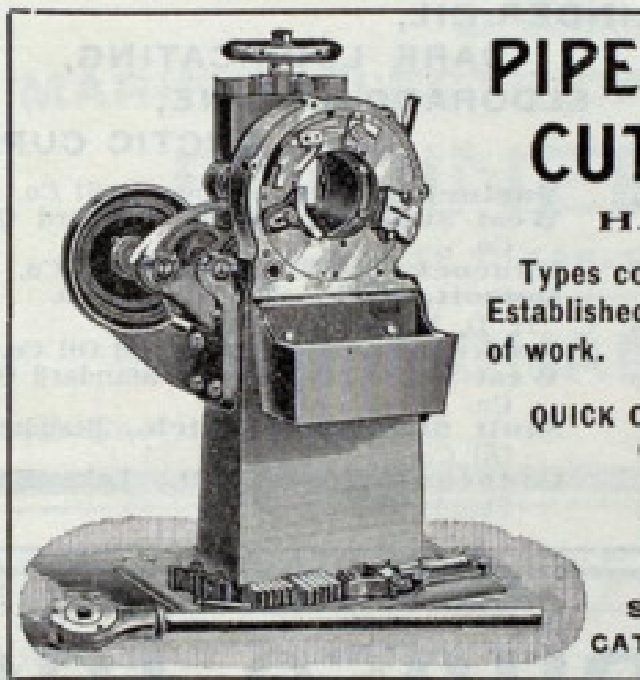

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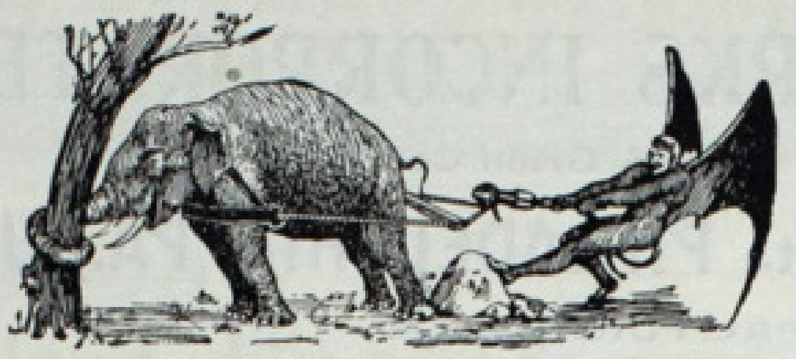

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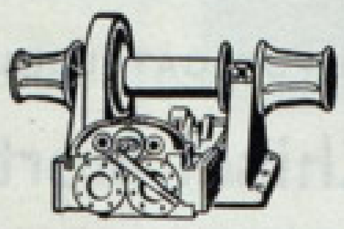

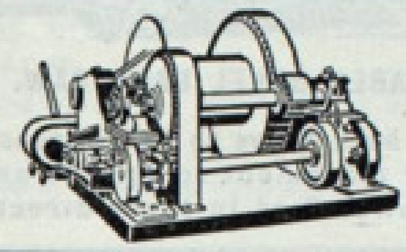

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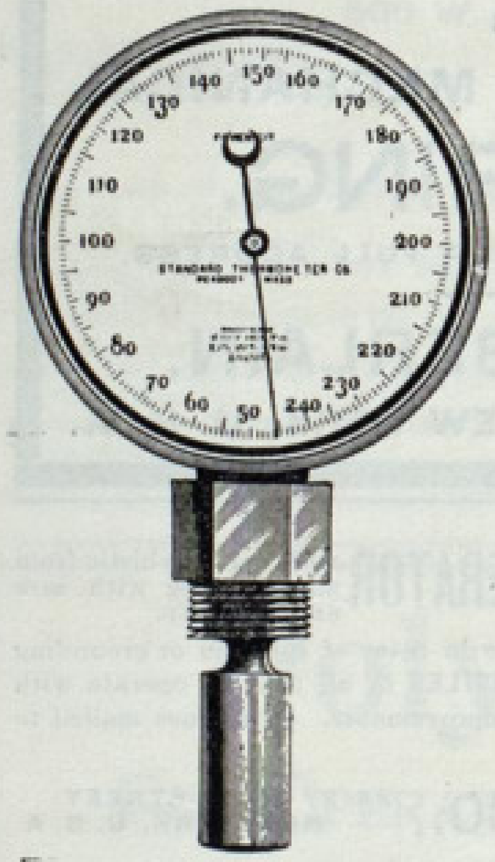

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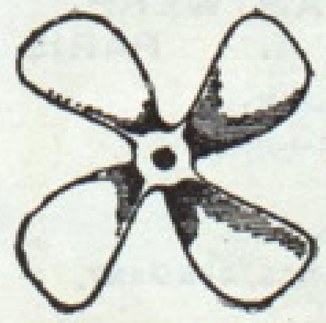

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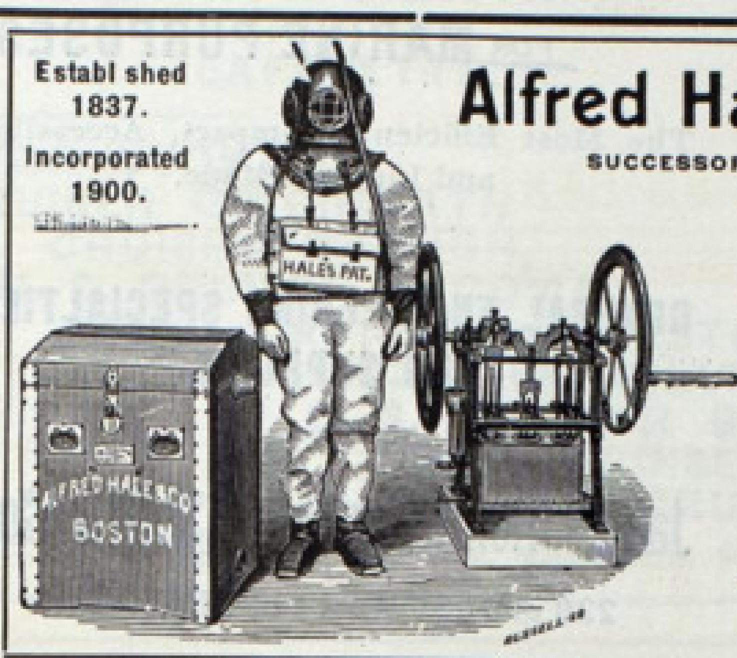

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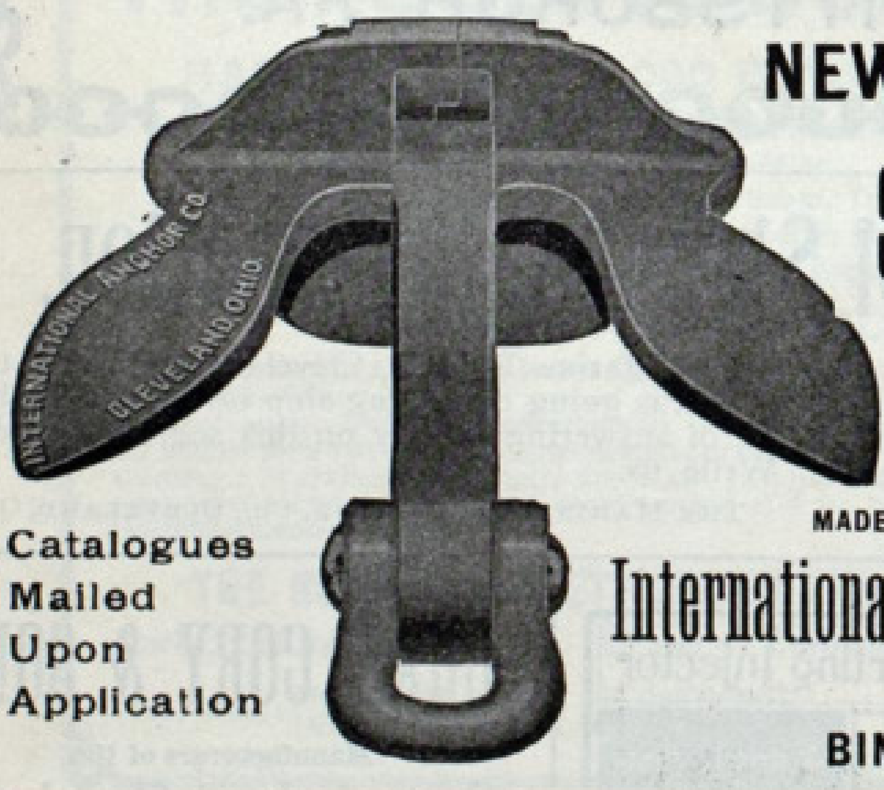

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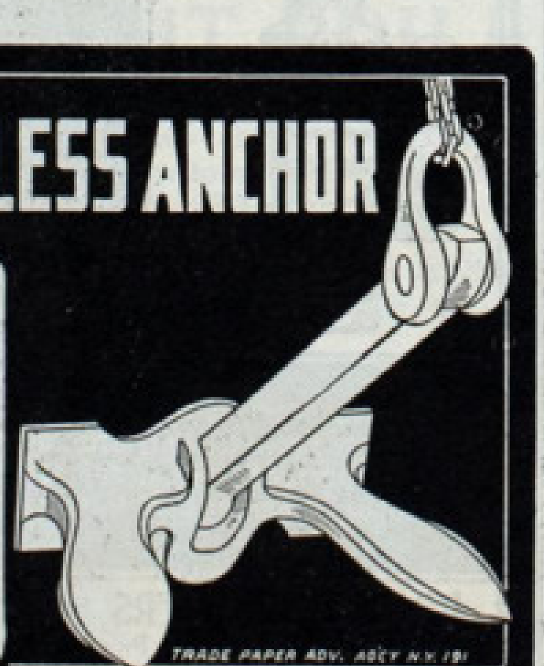

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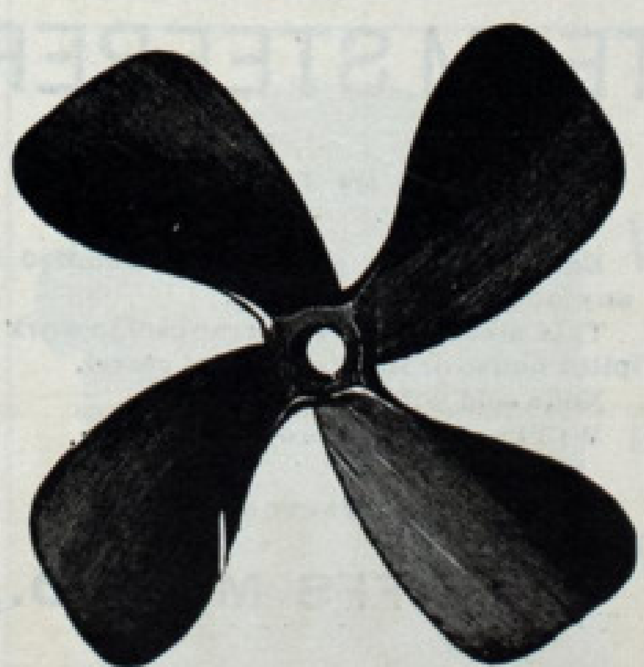

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